NRCS United States Department of Agriculture
Natural Resources Conservation Service

STRATEGIC APPROACH TO CONSERVATION

LAKE COUNTY

LAKE COUNTY NATURAL RESOURCES LONG RANGE STRATEGY

Contents

Section I. Introduction

Vision: Shared responsibility and commitment to local action achieves effective land stewardship.

Mission: Building alliances and strategically investing to effectively solve natural resource problems in Lake County, Oregon**.**

This Natural Resources Long Range Strategy lays out a road map for NRCS and its conservation partners to effectively address some of the most important and urgent natural resource problems facing Lake County. The purpose of the strategy is to identify priority resource problems, describe desired future outcomes, and establish measurable objectives so that NRCS and its partners can focus financial and technical assistance to achieve measurable and meaningful outcomes.

During the summer of 2010, the NRCS Lakeview Field Office conducted two Local Working Group meetings to gather input for the development of this document. During these special meetings, NRCS and its partners identified nine natural resource problems facing Lake County and prioritized the top four concerns based on the importance of each and our ability to treat them given current knowledge and technology.

NRCS gratefully acknowledges the assistance of the following partners in the development of this document:

Fort Rock-Silver Lake Soil and Water Conservation District
Lakeview Soil and Water Conservation District
Lake County Umbrella Watershed Council
Lake County Cooperative Weed Management Area
Oregon Department of Agriculture
Oregon Department of Fish and Wildlife
Oregon Department of Forestry
OSU Extension Service
USDA-Farm Service Agency

This Natural Resource Long Range Strategy covers the period from 2011–2015. The strategy will serve as the guiding document for NRCS decisions regarding delivery of financial and technical assistance and administration of Farm Bill programs. This is a living document, intended to be updated and modified, as appropriate, to account for emerging issues.

Section II. Natural Resource Inventory

This part of the field office long range strategy examines the natural resources inventory of the county as it relates to human, soil, water, air, energy, plant, and animal resource concerns. Many of these resource concerns have been addressed in other agency and stakeholder management plans, including but not limited to: *NRCS Rapid Watershed Assessment Profiles, Goose and Summer Lake Basins Agricultural Water Quality Management Area Plan, Oregon Department of Fish and Wildlife Conservation Strategy, Ore-Cal Resource Conservation and Development Area Plan, and Lake County Umbrella Watershed Council Plan.*

This point-in-time look at the natural resources and county demographics gives a starting point in addressing the existing resource concerns of NRCS and its partners. The following narratives, along with tables and figures, of each of the major resource concerns is reflective of the baseline data needed to guide this long range strategy.

A. Resource Concern: Humans

The population of Lake County has remained fairly constant over the past several decades due largely to the geographical location of the county in Oregon. U.S. Census Bureau data for 2010 indicates a 4.5 percent decrease in total county population to 7,089 people, which equates to less than one person per square mile. Approximately 38 percent of the population lives within urban areas. As shown in Figure 1, ownership of Lake County is approximately 22 percent private and 78 percent public (Federal and State).

Land cover types (Figure 2) for the county are approximately 65 percent shrub-steppe range or barren land, 20 percent forest or woodland, and 13 percent crop or pasture land, with the remaining two percent covered by open water. Land use (Figure 2) consists of approximately 75 percent grazing land, 12 percent forest land, 13 percent crop/hay/pasture, and less than one percent urban or developed areas. Privately owned lands encompass 515,258 acres of range and pasture, 279,000 acres of industrial and non-industrial forest, and 196,227 acres of crop and hay. Less than five percent of landowners in the county participate in government easement programs (Conservation Reserve Program, Wetlands Reserve Program, and Farm and Ranch Protection Program) which equal approximately 15,000 acres.

Today, as in the past, cattle ranching, timber and wood products, and irrigated hay are the major economic enterprises in the county. Climatic characteristics of this semi-arid region of the northern Great Basin limit the types of crops that can be produced. For this reason, irrigated grass hay and pasture and alfalfa hay dominate the agronomic operations. According to the 2007 Census of Agriculture, the average farm size is 1,661 acres. The number of farms in the county equal 417; twenty-six percent of these are over 1,000 acres in size. Only five Confined Animal Feeding Operations (CAFO) have been registered in the county. Animal feeding operations can be found on all ranches during winter months; concerns do exist where runoff from these feed grounds on frozen soils may reach water courses.

Resource Concern: Soil

Lake County topography (Figure 3) is typical of the intermountain west where closed basins are separated by mountain ranges formed by tilted fault blocks. Soils were formed by volcanic activity and deposited as alluvial or lacustrian sediments in prehistoric lakes. The general soils map (Figure 4) reflects the grouping of major soil series in the county; these exhibit a wide range of textures from clay to sand. Major Land Resource Areas of the county include Cascade Mountains-Eastern Slope, Klamath and Shasta Valleys and Basins, and Malheur High Plateau. Common Resource Areas, subsets of these MLRA's that exhibit unique soils, climate, and vegetation, are shown in Figure 5.

Erosion can be a problem on disturbed areas, especially on cropland where annually tilled crops are produced. The northern part of the county, Summer Lake and Fort Rock sub-basins, is dominated by sandy textured soils that are subject to wind erosion during early-spring and summer. This is reflected by the wind erodibility groups shown in Figure 6. Water erosion is not a major concern on most of the cropland soils because the area is in such a low annual rainfall zone. Water erosion can be a problem on forested soils at higher elevations that receive increased amounts of precipitation, usually caused by melting snow. Stream bank erosion is a concern on most perennial and seasonal streams in the county where spring flows cause severe down cutting of the channel and ice flows scour the banks in the deeper alluvial soils.

Soil structure, condition and fertility are critical factors for plant productivity on all land uses. Tree growth on forest land is affected by logging practices and soil compaction. Crop and hay production is dependent on soil condition and nutrients that are available for plant growth. Rangeland soils and forage production (Figure 7) are interrelated based on texture, slope, and depth to restrictive layers. Early-spring grazing, when soils are saturated, can cause compaction, pedestalling of plants, and loss of topsoil on steeper slopes.

Prime and unique farmland soils are listed in the electronic Field Office Technical Guide; these soils are found throughout the county primarily on deeper valley bottoms that are irrigated. Highly erodible soils, that are subject to wind or water erosion on cropland, are a concern when planning tillage and cropping systems. Hydric soils are found in the valley bottoms and along water courses. Adherence to the Food Security Act of 1985 rules, as amended, are needed to maintain farmed wetlands, farmed wetland pasture, and prior converted cropland, while not having a detrimental effect on natural wetlands. Highly erodible and hydric soils lists are also maintained in the Field Office Technical Guide.

B. Resource Concern: Water

Water is a precious resource in this semi-arid region of Oregon, thus water quantity and quality are major concerns. Annual precipitation (Figure 8) ranges from greater than 30 inches in the forested areas in the western part of the county to less than eight inches in the sagebrush-steppe area along the eastern boundary. Most precipitation comes in the form of snow during the winter and rainfall in spring and early-summer. Eight-digit hydrologic unit watersheds (Figure 9) and ten digit HUC sub-watersheds (Figures 10) need prioritization as focus areas to accomplish whole-watershed planning efforts to treat water quantity and quality issues.

The major streams of the county are depicted in Figure 11, many of which have only seasonal flows. Quantity and quality of water are concerns on nearly all of these major streams and rivers. Oregon Department of Environmental Quality has a number of the water courses on their 303d list for exceeding temperature standards for total maximum daily load (Figure 12). Lack of streambank vegetation, both herbaceous and woody species, has a detrimental effect on water quality.

Irrigation water is needed for all crop production in the county. Sources of irrigation water are from groundwater or streams and reservoirs. Surface irrigation water is largely dependent on winter snowpack for direct stream withdrawals or reservoir storage. Irrigation districts include Lakeview Water Users, Summer Lake Irrigation District, Silver Lake Irrigation District, and Warner Valley Water Users. Oregon Water Resources Department identified the Fort Rock Basin in the mid-1980's as a groundwater restricted area, and several other areas on the county have been classified as vulnerable or sensitive aquifer areas (Figure 13). Irrigation well water pumping has been a contributing factor to the aquifer depletion, and in some drought years, has caused domestic and livestock water wells to cease producing a sufficient outflow.

Quantity and quality of drinking water for livestock and wildlife is a resource concern that needs to be addressed. Distance to water can be detrimental to livestock and wildlife health, as well as, grazingland health and plant production and vigor. Dependable, season-long water sources are deficient in some areas of the county for both livestock and wildlife.

C. Resource Concern: Air and Energy

Air quality has not been identified by DEQ as a major problem in the county. Although, blowing dust can be a problem in early-spring on cropland that is tilled and left bare for too long. Cold air inversions during the winter can cause health risks from wood stove smoke in the Lakeview area. During wildfire season in summer and early-fall, smoke can blanket much of the populated areas of the county; this too can cause health risks to humans.

Energy costs are a concern for most farmers and ranchers. Electricity costs for pumping irrigation water from wells is a major portion of the operating costs for hay growers. Figure 14 shows the electric companies serving the county; rural electric cooperatives service most of the farms and ranches.

Alternative energy sources need to be investigated for farms and ranches for less dependence on fossil fuels. Solar, wind and biomass energy generation is a need for the near future. Planning efforts with Fremont Sawmill in Lakeview are continuing to establish a biomass electric power generation plant to run the mill. Geothermal energy has been developed to a minimal extent for use in the Lakeview area, with current investigations continuing to use geothermal energy for the public schools and the Lake District Hospital.

D. Resource Concern: Plants and Animals

As listed in Section II of the Field Office Technical Guide, there are a number of threatened and endangered animal and fish species identified in the county (Table 1). Other species of concern have been identified by Federal and State wildlife agencies. Consideration must be taken in all planning efforts to not put these species at risk. The *Warner Sucker Recovery Plan* is one example of efforts that have been made to improve the fish population in the Warner Basin, along with enhancement of this species critical habitat.

In the publication *Greater Sage Grouse Conservation Assessment and Strategy for Oregon* (ODFW, 2005), biologists and land managers laid a framework to manage bird populations and habitat to warrant not listing the sage grouse under the Endangered Species Act. Although the sage grouse was listed this year, efforts need to be made to treat the concern of habitat improvement to increase populations. High priority areas, within three miles of leks, are focus areas to begin enhancement projects (Figure 15). In *The Oregon Conservation Strategy (ODFW, 2006)*, wildlife conservation opportunity areas were identified throughout the county where improvement to habitat can be addressed in the future for upland big game, migratory waterfowl and fish species (Figure 16).

Invasive species and noxious weeds are a major concern for private landowners and public land managers. The Lake County Cooperative Weed Management Area encompasses the entire county, and scouting continues to identify noxious weed infestations. Partnering with the Weed Management Area Coordinator to control weed infestations for NRCS clients will be a high priority in future planning efforts.

Medusahead rye and western juniper continue to invade rangelands and decrease forage production and quality. Figure 17 reflects the potential for medusahead invasion on grazing lands based on soil types. This resource concern has been addressed to a minor extent in the past, but continued efforts need to be made to prevent the increased expansion of this species that will make rangeland unproductive. Poor rangeland health and pasture condition affects plant production and vigor. Implementing proper grazing and nutrient management are essential to increase plant productivity.

Priority waterbird areas (Figure 18) are essential habitat in spring for migratory waterfowl and wading birds. Concerns have been raised in the past, and must continue to be addressed in the future, when contemplating irrigation system conversions from surface to sprinkler. These priority areas are generally on heavy textured soils that are more conducive to flood irrigation.

Section III. Natural Resource Analysis

Analysis of conservation efforts by NRCS over the past ten years, 2000-2009, is demonstrated graphically in Figure 1 by showing areas of applied practices on a variety of land uses, including crop, hay, pasture, range, forest, and wildlife lands. Data from our performance measurement and contracting systems revealed that nearly 900 practices were applied on approximately 104,000 acres during that time period. Conservation planning was completed on nearly 136,000 acres of the various land uses county-wide during this time period.

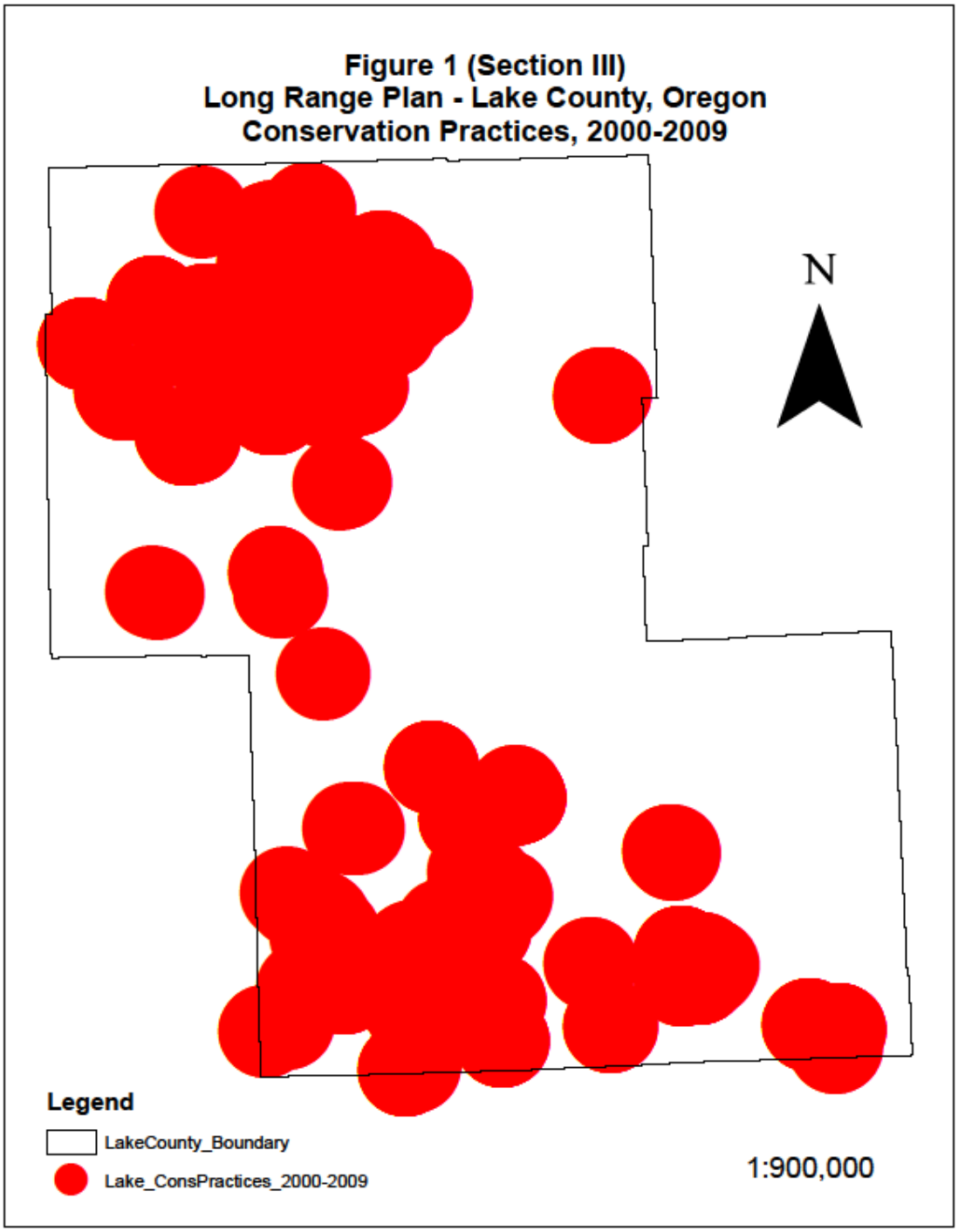
USDA farm bill programs, including Environmental Quality Incentives Program (EQIP), Wildlife Habitat Incentives Program (WHIP), Conservation Security Program (CSP), Wetland Reserve Program (WRP), and Farm and Ranch Protection Program (FRPP), have been utilized by private landowners to apply these conservation measures. In the EQIP, WHIP and CSP programs alone, 116 contracts have resulted in cost share and incentive payments of nearly five million dollars to stimulate the local economy. Through easement programs, WRP and FRPP, wetland values have been restored or enhanced on approximately 3,800 acres and potential for conversion from agricultural use was averted on 11,048 acres. A partial listing of the major conservation practices implemented during the past ten years is shown in Table 1. Numbers of customers, fields and acres that have been treated by USDA programs are shown in Table 2.

Table 1: Conservation Practices Applied, 2000-2009

Conservation Practice	Amount Applied
Brush Management (sagebrush, rabbitbrush and juniper)	4,410 acres
Fence	185,697 feet
Range and Pasture Plantings	2,029 acres
Pipeline (for livestock water systems)	44,209 feet
Watering Facility (troughs and tanks)	33 each
Prescribed Grazing	28,298 acres
Irrigation System, Sprinkler	7,120 acres
Irrigation Water Conveyance Pipeline	96,238 feet
Irrigation Water Management	12,503 acres
Filter Strip/Riparian Buffers	222 acres
Streambank and Shoreline Protection	36,720 feet
Forest Stand Improvement	94 acres

Program	Unique LU Acres	Unique #Fields	# of Customers	# of Practices
CRP	1330	29	10	98
CTA-GENRL	14704.2	81	19	106
CTA-GLC	12625.2	41	12	57
EQIP	60949.7	228	61	439
EQIP-GSWC	5309.7	59	27	179
WHIP	3878.4	3	3	7
WRP	3405.2	4	2	12
Grand Total	**85619.7**	**382**	**87**	**898**

Table 2: Applied Practices by Program (2000-2009)



Further evaluation of past performance reveals that thirty-four different NRCS practices have been planned and applied to the private agricultural areas in the county. Of the total number of practices implemented, approximately 77 percent of these have been applied in three major HUC8 watersheds, Summer Lake, Goose Lake, and Warner Lakes, as reflected in Table 3.

Table 3: Practices Applied by HUC8 Watershed (2000-2009)

Watershed/HUC8 Code		Summer Lake 17120005	Lake Abert 17120006	Warner Lakes 17120007	Guano 17120008	Sprague River 18010202	Goose Lake 18020001	Grand Total
Practice Name	**Units**							
Access Control	acres	306.2					3505.9	3812.1
Brush Management	acres	1832.5	505	384			1138	3859.5
Conservation Cover	acres	552.2					850	1402.2
Conservation Crop Rotation	acres	425.8						425.8
Critical Area Planting	acres						0.2	0.2
Filter Strip	acres						5.2	5.2
Forage and Biomass Planting	acres			104			94.7	198.7
Forage Harvest Management	acres	2278		818.1			553.7	3649.8
Forest Stand Improvement	acres		52					52
Integrated Pest Management	acres	27.7					117.5	145.2
Irrigation Land Leveling	acres						31.7	31.7
Irrigation System, Sprinkler	acres	5413.9	160	778.1			1452.7	7804.7
Irrigation Water Management	acres	6599.7	90	829.8			1893.5	9413
Obstruction Removal	acres						1	1
Prescribed Grazing	acres	6120.9	1560	352.4	10000		14973.9	33007.2
Range Planting	acres	190			600		415	1205
Riparian Forest Buffer	acres						105.5	105.5
Tree/Shrub Establishment	acres						12	12
Upland Wildlife Habitat Management	acres	6256	40	1397			3528.7	11221.7
Wetland Restoration	acres					1630	897.5	2527.5
Wetland Wildlife Habitat Management	acres						442.5	442.5
Fence	feet	23724	9660	6452			82004.6	121840.6
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	feet	14067	647	24429			36374	75517
Irrigation Water Conveyance, Pipeline, Low-Pressure, Underground, Plastic	feet						2620	2620
Irrigation Water Conveyance, Pipeline, Steel	feet	26.5						26.5
Pipeline	feet		280	300	35500		6870	42950
Streambank and Shoreline Protection	feet						100	100
Fish Passage	miles			2				2
Dam, Diversion	number						1	1
Grade Stabilization Structure	number			25				25
Pumping Plant	number	23	3	9	2		21	58
Structure for Water Control	number	74	1	86			305	466
Water Well	number	3	1				4	8
Watering Facility	number	3	6	2	6		10	27

Direction for these conservation efforts comes through the Lake County Local Working Group (LWG) represented by local, State and Federal agency personnel and stakeholder groups. Spearheaded by the two Soil and Water Conservation Districts in the county, this working group has provided guidance to NRCS by identifying priority resource concerns. The two major concerns which have been addressed during the recent past include 1) inefficient use of water on irrigated lands, which effects water quantity and quality on cropland and pastureland, and 2) water quality on uplands, especially range and forest where invasive species have been detrimental to native plant populations. To address these priority resource concerns, NRCS has taken a watershed or geographical priority area approach to solving the problems.

One focus area for addressing the water quantity issue on cropland has been the Fort Rock sub-basin of the Summer Lake Basin. This area has been under a moratorium preventing issuance of new groundwater rights for irrigation by the Oregon Water Resources Department (WRD) since the mid-1980s. Long-term data from test wells in the region has shown a gradual decrease in groundwater aquifer levels since the 1930s. In 2004, NRCS initiated cost share efforts through EQIP to assist landowners to improve irrigation water conservation by monitoring soil moisture and improving efficiency by upgrading sprinkler irrigation systems and converting from surface to sprinkler systems. Other areas of the county identified by WRD as 'Sensitive Aquifer Areas' were targeted by NRCS for similar assistance, and irrigators in the Goose Lake and Warner Lakes basins have benefited from system conversions or replacements.

The second priority resource concern involving water quality on uplands mainly focused on invasive species on grazing lands, but treatments have also benefited livestock grazing management and upland wildlife management. Post-European settlement has seen an increase in western juniper encroachment on range and forest lands. Researchers contribute the absence or control of periodic wildfire to this juniper invasion which has created water quality and soil erosion problems by decreasing shrub-steppe grasses, forbs, and shrubs components in range ecosystems. For the past five years, NRCS has focused attention on this invasive species concern, by considering uplands county-wide which were plagued with increasing juniper stands. Mechanical control methods, under the Brush Management practice, have treated over 2,200 acres in the past ten years.

More recently, this same issue of juniper management has taken a new approach by focusing efforts on Greater Sage Grouse habitat management on a regional scale through a NRCS nation-wide initiative. Designated funding allocations through EQIP and WHIP have been approved to focus efforts to enhance and rehabilitate current sage grouse range. In Lake County, the Warner Basin focus area for sage grouse was targeted in 2009; initially 1,600 acres were contracted for treatment, with a goal of 5,200 acres receiving mechanical treatment within the next five years. The Bureau of Land Management (BLM) has targeted 25,000 acres of public land in this southern Warner Mountains area for juniper management to improve sage grouse habitat. Oregon Department of Fish and Wildlife (ODFW) is also a major partner in this effort and have provided technical and financial assistance on past projects.

Noxious weeds have been identified as a priority resource concern for the Soil and Water Conservation Districts (SWCD), private landowners and public land managers. The Lake County Cooperative Weed Management Area encompasses the entire county, and scouting continues to identify noxious weed infestations, including a variety of thistles, knapweeds, toad flax, leafy spurge, Mediterranean sage, and white top. Partnering with the Weed Management Area Coordinator to control noxious weeds affecting NRCS clients' operations will be a high priority in future planning efforts.

Medusahead rye invades heavy-textured soils on rangelands, which leads to decreased quality and quantity of desired native grasses and forbs. This resource concern has been addressed by the Lakeview SWCD to some extent in the past, but continued efforts need to be made to prevent the increased expansion of this species. Incorporating prescribed grazing, in conjunction with pest management, is essential for increasing plant productivity and improving rangeland health on these infested lands.

Forest health is a resource concern that should be addressed on the 278,700 acres of private forest lands in the county. The 'Red Zone', as identified by State and Federal forest management agencies (Oregon Department of Forestry and U.S. Forest Service), is an area that is infested with pine bark beetle and has caused tree mortality on thousands of acres. Many areas of the County's forest land, dominated by white fir, still have standing dead trees that were the result of drought years in the late-1980s and early-1990s. These areas of insect-infested and drought-affected trees all contribute to the threat of catastrophic wildfires. Work needs to be done in the future with private landowners for forest stand improvement, slash treatment, and reforestation plantings.

Soil erosion is, and has been, a priority resource concern of the SWCDs. Wind erosion on cropland has been addressed by NRCS through compliance plans under the Highly Erodible Land conservation provisions of past Farm Bill legislation. Quite recently, the Fort Rock-Silver Lake SWCD has recognized a need for increased efforts of preventing soil erosion on cropland during the critical wind erosion period of spring and early-summer when irrigated alfalfa fields are in the small grain phase of the crop rotation. Reduced tillage and no-till alternatives need to be considered for the nearly 90,000 acres of irrigated croplands in these wind-affected areas.

Streambank erosion was a major concern of the SWCDs in the 1980s and 1990s, and considerable work was completed by the SWCDs and NRCS to address stream channel degradation and bank erosion. Many miles of riprap and numbers of grade stabilization structures, as well as critical area plantings, were implemented. The SWCDs still consider this resource concern a high priority and have been able to complete a number of projects without NRCS assistance. Within the last ten years, the majority of projects addressing riparian corridor erosion have been undertaken by the five Watershed Councils in the county. Through Oregon Watershed Enhancement Board (OWEB) funding, the Watershed Councils have completed streambank erosion projects that were once considered as potential or priority concerns by NRCS and the SWCDs. The potential still exists for NRCS to address this resource concern through partnering efforts on projects with the SWCDs and Watershed Councils to treat many additional miles of streams.

Other conservation efforts in the past have been achieved through partnership efforts and special emphasis programs during natural disasters. The Farm Service Agency, through the Emergency Conservation Program, has offered costshare assistance to develop livestock water systems during drought years. The Watershed Councils and SWCDs have utilized Oregon Lottery funding through OWEB grants to implement twenty-two projects during the 2007-2009 biennium to control livestock grazing in riparian areas by fencing and off-stream water projects, stream restoration through native shrub and tree plantings, weed and invasive species control on uplands, and improving fish passage on streams. NRCS utilized the Emergency Watershed Program (EWP) funding following wildfires in 2002 and 2007 to prevent soil erosion by implementing critical area plantings on steep slopes denuded of all vegetation. In 1999, NRCS cooperated with the Town of Lakeview, Lake County, and Lakeview SWCD to control catastrophic flooding events in Lakeview by utilizing the PL-566 program to fund a two million dollar project to construct a flood retarding structure on Bullard Creek above the town.

From a human social and economic resource concerns perspective, services to historically underserved clients (beginning farmers and ranchers, limited resource producers, and socially disadvantaged persons) has increased over the past ten years. Especially in the last five years, the number of historically underserved participants in EQIP was twenty-two, as compared to seven during the previous five year period. This resulted in increased costshare and incentive payments to underserved clients from $105,859 (years 2000-2004) to $856,548 (years 2005-2009). Through outreach efforts and partnership collaboration on projects, assistance to the historically underserved will continue to improve.

In conclusion, conservation efforts to prevent soil erosion, improve water quality and quantity, control noxious weeds and invasive species, restore streams and wetlands, improve forest and grazingland health, manage livestock grazing, and enhance wildlife habitat by NRCS and our partners has enhanced and conserved Lake County's natural resources. Although past projects have been beneficial, continued efforts are need by the partnership to share technical and financial resources to treat additional concerns under natural conditions or unforeseen catastrophic events in future years.

Section IV. Natural Resource Problems and Desired Future Outcomes

Invasive Species

What is the severity of the problem?

The Lake County Cooperative Weed Management Area (LCCwMA) has identified 22 species of noxious weeds that are invading crop, range, pasture, and forest lands throughout the county. Knapweeds, leafy spurge, thistles, etc., are depleting the habitats for mule deer, Greater sage grouse, livestock, and other wildlife. At least 20,000-25,000 acres are affected by all different types of noxious weed species.

Western juniper is encroaching into the 515,000 acres of range and pastureland, and the 130,000 acres of private forestland. Juniper trees can affect the hydrologic function of rangeland and controlling juniper can immediately improve sage grouse habitat, along with other types of wildlife and livestock habitats.

Priority areas within the county were decided on by the NRCS, partners, and the Local Work Group and are as follows:

- Warner Valley, which includes 5,500 acres of private rangeland with phase I and II juniper stands.
- Drews Valley, which was chosen for its 5,000 acres of mule deer habitat management area encroached by juniper that needs to be restored.

Who is willing to help with this resource concern?

The Lake County Umbrella Watershed Council, Lakeview Soil and Water Conservation Districts, Fort Rock-Silver Lake Soil and Water Conservation District, Oregon Department of Fish and Wildlife, and the Bureau of Land Management are working with the NRCS to reduce invasive species and restore plant productivity and wildlife habitat in the county.

Resource Trends

Researchers contribute the invasion of juniper to the absence of periodic wildfire, which has created water quality and soil erosion problems due to the decreased shrub-steppe grasses, forbs, and shrubs on the rangeland.

For the past five years, the NRCS has focused on the invasive species problem and used methods such as brush management as a conservation treatment. The NRCS and partners have treated over 2,200 acres in the past 10 years. This has made only a small impact on the problem as the juniper encroachment is getting worse due to fire suppression. The future looks good if continued partnerships increase efforts and continue to make this problem a priority in the county.

What are the goals?

- Reduce invasive species, particularly juniper
- Restore native grassland to increase plant productivity
- Restore wildlife habitats

The most efficient and acceptable strategy for reducing juniper is brush management. Prescribed burning has been an effective method for juniper removal, however, the increased liability to landowners and forest fire risk in Lake County eliminates that option. Juniper removal will help restore native grass and shrub stands and increase water availability, increasing water quality and quantity. A concern in implementing the brush management is the lack of contractors and the high cost for removal of juniper, however, last year 1,600 acres were contracted in one year for two landowners. If the invasive species issue continues to be a priority for landowners and agencies that are able to contribute funding, 1,000-1,500 acres a year should be able to be treated for removal of juniper in the future. At least 10 years will be needed to mitigate the juniper problem if this rate continues.

Aside from juniper, other invasive species will undergo chemical weed treatment and landowners should work with the LCCwMA Coordinator to decide the best weed management plan and determine a target area. This problem should be handled in 10-15 years.

The designated priority areas will be the starting point for treatment. This will also address and support the Sage Grouse Initiative and Mule Deer Habitat Restoration Strategy. Outreach will occur with the landowners in these areas to assure cooperation and educate on the funding the NRCS offers through cost-share assistance programs such as EQIP.

How much funding is needed?

For juniper, $94-$141 is needed per acre for cutting, and slash treatment for removal is $116 per acre. If the juniper can be treated in phase I, it will only require $28 per acre to cut and drop the trees.

Control of medusahead rye will use the chemical Plateau, or herbicides recommended by licensed pesticide applicators, and an aerial approach will be used for application. This will cost about $36 per acre. Thistles and knapweeds can be treated with ground application and should be about $30 per acre.

Riparian Health

What is the severity of the problem?

Steep, nearly vertical stream banks in riparian areas are causing a countywide problem for riparian health. This is caused by high stream and ice flows in spring that scours the banks and depletes stream bank plants that provide stream shade, such as willows. The vegetation void is a major cause of the TMDL listings for temperature, which is assigned to most streams in the county due to the lack of shade and vegetation. Work has been done on this issue in the past but not for many years and the potential still exists for the NRCS to address this resource concern through partnering efforts on conservation projects.

Who is willing to help with this resource concern?

The NRCS is expecting to work on the riparian health issue with the Watershed Councils, Lakeview Soil and Water Conservation District, Fort Rock-Silver Lake Soil and Water Conservation District, private landowners, and the Oregon Watershed Enhancement Board.

Resource Trends

Stream bank erosion was a major concern in the 1980's and 1990's and considerable work was completed by the Soil and Water Conservation Districts and the NRCS to address stream channel degradation and bank erosion. Loose-rock grade stabilization structures and riprap projects on eroding stream banks were installed and used for the problem. Very little work has been done on the subject since then due to a lack of engineering assistance within the agency. Low snow pack years have caused less extreme run off situations than those that occurred in the 1990's.

What are the goals?

- Improve riparian health
- Increase stream conditions

More detailed stream surveys may be needed and the watershed council is implementing those and will note changes and plan accordingly when the results are known.

Planting more vegetation on stream banks such as shrubs and willows should help streams reach the proper functioning condition. Stream bank restoration projects and grade stabilization structures should help stream banks lose their steep, vertical shape and allow more slope vegetation to slow water, reduce erosion, and eliminate problems downstream.

Attention will be given to protect areas from livestock grazing on fragile stream bank areas. Work with the Farm Service Agency should help incorporate CREP and Continuous CRP contracts with cooperators, which will help restore riparian areas. Outreach will educate landowners in the hopes of getting priority areas signed up for contracts to get work started. Word-of-mouth should help spread the message and encourage other landowners to follow conservation efforts occurring on the beginning projects. In five years there should be visible evidence of less steep grades and vegetation growth. This project should be complete in 10-20 years depending on funding and participation.

How much funding is needed?

The NRCS and partners hope to repair 30-40 miles of riparian areas and will require about $215-$325 per lineal foot of bank.

Water Quantity and Quality

What is the severity of the problem?

Irrigation inefficiencies are creating water quantity and quality concerns, for groundwater, on cropland in Lake County. A focus area for addressing this issue has been the Fort Rock sub-basin of the Summer Lake Basin. This area has been under a moratorium preventing the issuance of new groundwater rights for irrigation by the Oregon Water Resources Department since the mid-1980's.

Surface water issues involve direct stream flow takeout for irrigation. The Oregon Department of Fish and Wildlife would like to see areas and acres improved for migratory birds, making this also a wildlife concern and more of a priority. Improving the infrastructure of flood irrigation systems should help benefit water birds and spring and summer habitat on flooded fields.

There are also several Threatened and Endangered, T&E, species that need to be considered, particularly in the Warner Lakes Basin where the Warner Sucker is endangered. The Goose Lake Basin provides habitat for Goose Lake redband trout, Goose Lake lampreys, Goose Lake sucker, and tui chub. These species are not yet endangered but are sensitive and precautions need to be taken to ensure they stay off of the T&E species list. Flumes need to be eliminated and monitoring needs to regulate water loss to increase water quality for fish habitat as well.

Land leveling and smoothing is needed to better utilize water and get it across the field faster to avoid over-irrigation. Sprinkler conversion will be needed on soils that can't support flood irrigation.

Who is willing to help with this resource concern?

The Watershed Councils, irrigation districts, Soil and Water Conservation Districts, and the Oregon Water Resources Department are working with the NRCS to improve water quality and quantity in the county.

Resource Trends

The fish problem has declined in the past due to the efforts of the Oregon Department of Fish and Wildlife.

Little work has been done to update flood irrigation systems. There has been no obvious improvement in the water resource concern recently.

What are the goals?

- Improve irrigation efficiency
- Increase water quantity
- Improve water quality, particularly for fish passage and habitat

The Fort Rock sub-basin still has interest in irrigation efficiency projects and would like to have NRCS offer cost share assistance to replace the pivots that are past the service life. There are not many wheel lines anymore but the updating of old center pivots is needed in this area.

Work is needed for on-farm improvement and reorganization of delivery ditches. Fields may need to be tilled and replanted when converting to sprinkler irrigation and land smoothing will improve delivery. Plant growth and increased soil quality should be seen after these improvements are implemented.

The Lakeview Water Users irrigation district has a degraded flume that would like to see replaced with a siphon that would help reduce water loss by eliminating nine miles from the north canal. This would be a multi-million dollar project and may not be feasible to fund but is still a major problem.

Work in the Goose Lake Basin will be a starting point and should be about 1/3 of the problem area as this is where the flume is.

Countywide monitoring will need to be done to regulate water quantity and use.

How much funding is needed?

There are about 5,000-10,000 acres that are in need of improvement, either conversion to sprinkler irrigation or surface system reorganization. Average costs are $355 per acre for sprinkler systems. Laying out new ditches and land leveling is where price will increase to about $420-$500 per acre.

Soil Quantity and Quality Related to Wind Erosion

What is the severity of the problem?

Soil erosion has been a priority resource concern in the county and is a future concern as well, particularly the Lake Abert and Summer Lake Watersheds. On cropland, erosion period is March to mid-June. Many farmers still use conventional tillage, and the fine particles in the sandy textured soils combine with the frequent 30 mph winds create blowing dust areas. There is concern about the loss of top soil and more people in the area are complaining of low visibility during blowing periods and the significant amount of dust in living areas. Air quality is also affected as visibility is inhibited during blowing dust periods.

Dirt roads also produce blowing dust, not only during erosion periods but also harvest months when low rainfall creates dry periods.

Who is willing to help with this resource concern?

The NRCS hopes to work with the Soil and Water Conservation Districts, Oregon Department of Agriculture, and the Oregon State University-Extension to help decrease soil erosion in Lake County.

Resource Trends

This problem has increased as soil quality has continued to decrease and nothing has been done to treat the erosion problem. The Conservation Stewardship Program once had a dust treatment enhancement for access roads, but it was dropped from the program.

What are the goals?

- Decrease soil erosion related to wind
- Increase soil quality

A highly hazardous area should be designated to serve as a starting and test area. Regulatory agencies or the Department of Environment Quality should monitor dust levels on roads and fields.

It would be beneficial for the Conservation Stewardship Program to reincorporate dust treatment. Treatment, such as gravel or chemicals, is needed to keep dust down on dirt roads. Chemicals should replace tillage to kill old alfalfa stands.

According to the district, the goals can be achieved by incorporating no-till, minimum tillage, or direct seeding methods into the farming systems. There is a no-till drill in the county but hasn't

been tested to observe the results. Completing a trial run and demonstration projects will help show the benefits to soil quality while producing similar yields as to what are currently being seen.

Outreach needs to continue to educate on the benefits of no-till and promote use. The hope is that once a few progressive farmers get on board and get started, the trend will spread and more farmers will convert to no-till or similar methods.

How much funding is needed?

The NRCS is unsure of the funding required at this juncture. Once outreach happens and the number of interested landowners is known, it will be easier to calculate costs. A recent NRCS practice payment schedule scenario reflected an average cost of $30.19 per acre for a no-till seeding.

Section V: Prioritization of Natural Resource Problems and Solutions

The Lake County Local Working Group met twice during the summer of 2010 and prioritized the county resource concerns as follows:

Resource Concern	Specifics
Invasive Brush Management and Noxious Weeds	Juniper control-Goose Lake Valley/Drews Valley, treatment is site specific and include cutting, burning, fallen juniper without treatment, post treatment plan of action needed, need for monitoring Effects are: declining wildlife habitat, soil erosion, decreased soil productivity, less water savings Noxious Weeds- new problem within the last 20 years, medusahead rye is showing up in new areas such as Winter Rim, there is no current treatment but is still at a treatable stage on small acreages, puncture vine is present around Paisley, need financial assistance to help eradicate weeds and need to educate on a more broad scale
Riparian Process/Function	Tributaries to Thomas Creek, Crooked Creek, Drews Creek, Buck Creek, Silver Creek, and Bridge Creek Countywide problem Bank stabilization needed and shade needed to reduce stream temperatures Need to improve water table and meadows
North Lake Irrigation Water Quantity and Efficiency	Fort Rock sub-basin, irrigation water inefficiency and water quantity Current NRCS priority for 2011 EQIP, VFD pumps are included, system upgrades and replacements are needed, moisture monitoring needed, flow measurement devices are being installed
Wind Erosion	Lake Abert and Summer Lake watersheds Loss of soil, blowing dust, no regulatory agencies, legislature may pass dust control bill

Surface Water Users	Goose Lake, Warner Lakes, and Summer Lake watersheds Countywide monitoring needed Attention is needed for on-farm delivery and fish passage and screening
Forest Health	Overstocking leaves forestland vulnerable to diseases, insects, and wildfires Beetle kill in the "Red Zone" and other areas
Climate Change	What impact do changing weather conditions have on agriculture and conservation?
Education/Outreach	Expensive projects focusing on specific areas have a greater impact, it can be hard to get full landowner participation, and NRCS is relying on partner input

The following resource concerns were viewed as having the highest priority among working group members. The NRCS and partners are focusing funding opportunities and conservation efforts in these problem areas for the period covered by this long term strategy.

1. Invasive Species – Brush Management and Noxious Weeds

Landowners countywide are willing to participate in this effort as invasive species diminish the grazing capability, decrease stream quality, and destroy wildlife habitat.

Partner contribution is as follows:

The Watershed Council, Lakeview and Fort Rock-Silver Lake Soil and Water Conservation Districts, Oregon Department of Fish and Wildlife, the Department of Land Management are working with the NRCS to reduce invasive species and restore plant productivity and wildlife habitat in the county.

Success will be measured by anecdotal evidence from the landowner and the number of applied EQIP contracts for rangeland health.

2. Riparian Health and Function

Private landowners countywide are willing to participate in riparian improvement as the riparian areas affect water quantity and plant health.

Partner contribution is as follows:

The NRCS is expecting to work on the riparian health issue with the Watershed Councils, Lake Soil and Water Conservation Districts, private landowners, and the Oregon Watershed Enhancement Board.

Success will be measured by water quality assessments and applied EQIP contracts for conservation treatment practices for riparian areas in Lake County.

3. Water Quality and Quantity

Crop producers and citizens of the county are willing to participate in this effort as water conservation and adequate water quality and quantity is essential to everyone.

Partner contribution is as follows:

The Watershed Councils, irrigation districts, Soil and Water Conservation Districts, and the Oregon Water Resources Department are working with the NRCS to improve water quality and quantity in the county.

Success will be measured by feedback from the local irrigation districts, water quality assessments, and the number of irrigation systems updated for efficiency.

4. Soil Erosion - Wind

Crop producers are willing to participate in efforts to control soil erosion as it affects soil quality, quantity and plant productivity.

Partner contribution is as follows:

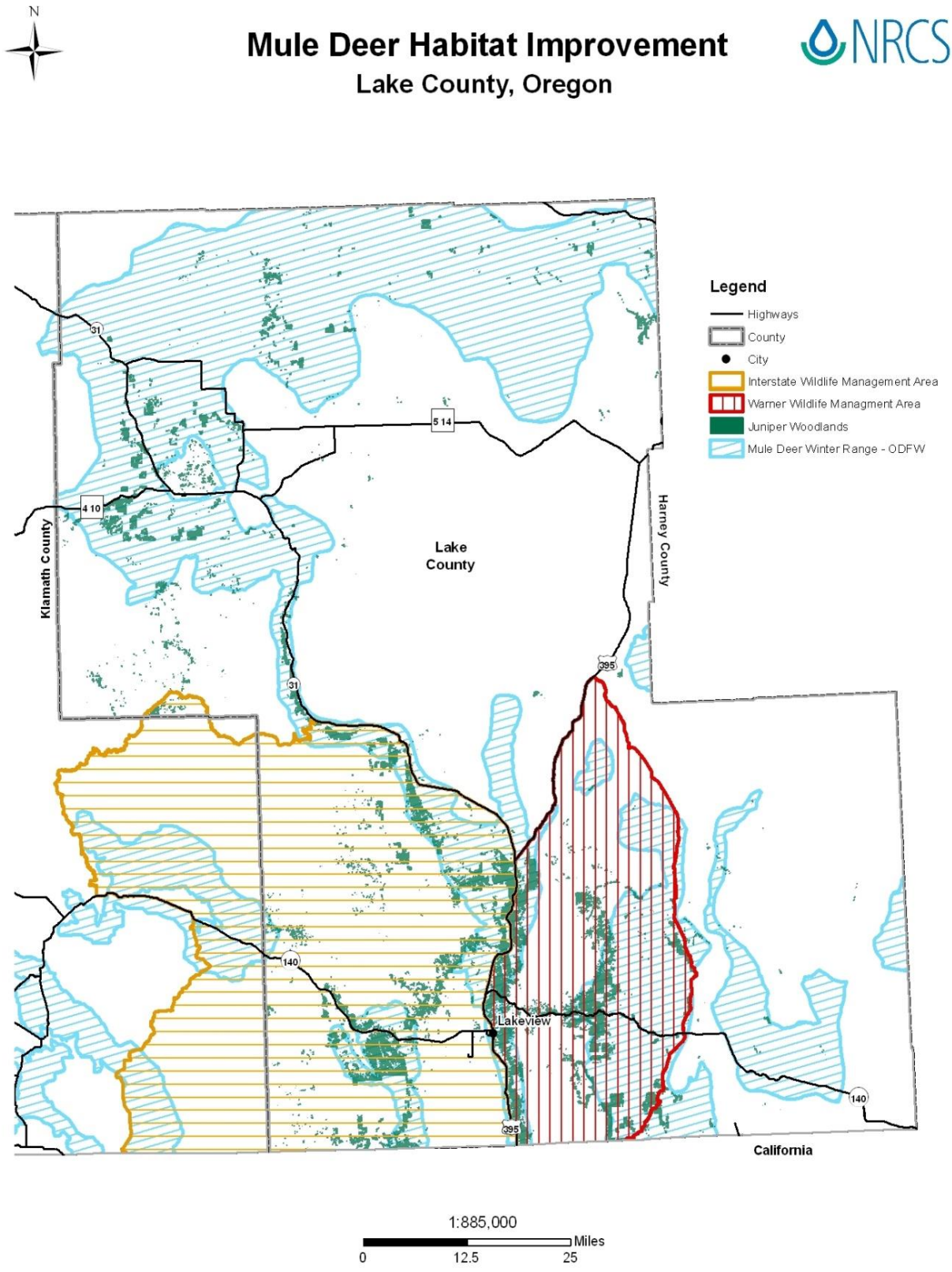
The NRCS hopes to work with the Soil and Water Conservation Districts, Oregon Department of Agriculture, and the Oregon State University-Extension to help decrease soil erosion in Lake County.

Success will be measured by future soil surveys and feedback on the visible evidence from landowners.

Section VI: Conservation Implementation Strategies

A Conservation Implementation Strategy will be developed for each of the four priority resource problems. These strategies will be developed over the course of the next five years and added to this document as they are developed.

The following pages reflect implementation strategies for addressing the invasive species priority resource concern. Brush management for controlling encroaching juniper on grazing lands will improve mule deer winter range habitat; approved in 2012, this strategy will continue through 2016. The second strategy is to control medusahead, an invasive annual grass species, on grazing lands in the Lake Abert and Goose Lake basins; approved and funded for 2013, this strategy is to continue through 2016. A third strategy is to improve shallow-water habitat for spring migrating waterfowl. Surface-irrigated pasture and hay lands in the SONEC region provide valuable habitat for many species of waterbirds during spring migration.


N
Mule Deer Habitat Improvement
Lake County, Oregon
NRCS
Legend
Highways
County
City
Interstate Wildlife Management Area
Warner Wildlife Managment Area
Juniper Woodlands
Mule Deer Winter Range - ODFW
Klamath County
Lake County
Harney County
California
Lakeview
31
5 14
4 10
395
140
1:885,000
Miles
0
12.5
25

Encroachment of Western juniper (*Juniperus occidentallis*) onto rangeland was identified in 2010 by the Lake County Local Working Group, an advisory body to the Natural Resources Conservation Service, as the number one resource concern to be addressed within the next five to ten years. This expansion of juniper, beyond its historic range throughout much of Lake County, has resulted in significant loss of bitterbrush, mountain mahogany, and aspen stands, which provide important habitat for mule deer. Once the perennial herbaceous and shrub species are eliminated, the risks of soil erosion, invasive weeds, and poor water quality increase for the ecosystem. For these reasons, juniper management was incorporated into the NRCS Long Range Strategy as a major resource concern.

OVERVIEW/BACKGROUND

In 2009, Oregon Department of Fish and Wildlife published the *Oregon Mule Deer Initiative Plan* (MDI Plan), which outlines the issues associated with the decline of mule deer numbers in Oregon and develops strategies to reverse that trend. According to the MDI Plan, western juniper encroachment is a significant factor contributing to the degradation of mule deer habitat and decline of mule deer populations in Oregon. This is especially true where juniper has encroached into and displaced bitterbrush, mountain mahogany, and aspen stands. Low fawn recruitment, severe winters, dry summers, changing predator/prey relationships, and increased habitat loss have pushed deer populations lower than the Oregon Department of Fish and Wildlife (ODFW) and the public desire.

This implementation strategy will focus on improving mule deer winter range on private grazing lands. The Warner Wildlife Management Unit (WMU) encompasses the Warner Mountain range and foothills in southern Lake County. Because this WMU was identified as a priority area in the ODFW plan, NRCS designated this as the primary focus area in 2012. The Drews Creek watershed was deemed the secondary focus area in 2012, but at the request of ODFW biologists, the entire Interstate WMU, which the Drews Creek watershed is part of, will be the secondary focus area for habitat improvement in 2013 and beyond. ODFW considers these areas as critical mule deer winter range and requested through the local working group process the need to improve big game habitat.

The Warner WMU is approximately 614,000 acres; the area is 39 percent private ownership, although only 23,844 acres are in juniper woodland on mule deer winter range. The Interstate WMU overlaps the boundaries of Lake and Klamath counties in Oregon; the Lake County portion encompasses 877,803 acres. Of this total, juniper woodlands on winter range under private ownership only account for 17,833 acres.

ODFW and the Lake County Umbrella Watershed Council have been working with landowners in these watersheds on juniper control projects and desire to partner with NRCS to treat additional acres. Through partnerships with State and local agencies, NRCS can assist private landowners to address this major resource concern. It is imperative that the expansion of juniper be reversed now by treating the early stages of plant succession, referred to as Phase 1 and 2 stands, before having a detrimental effect on beneficial plant production and the threshold is crossed where the understory plants are lost forever. This would make restoration more economically prohibitive to reincorporate perennial herbaceous and shrub species into the ecosystem.

PROBLEM STATEMENT

Plant productivity is affected by juniper encroachment, and as stands increase in density, valuable perennial grasses and shrubs decrease in abundance and production. These plants are necessary for both livestock and wildlife production. Less soil moisture is available for grass and shrub growth, resulting in reduced plant vigor and eventual mortality to the understory vegetation.

Juniper encroachment on range and forest lands is presenting a detrimental effect on wildlife habitat throughout Lake County, including the Warner and Interstate units. This invasion into sagebrush and bitterbrush dominated rangeland and also aspen and mountain mahogany groves can have a devastating effect on food and cover for mule deer. Over time, the native shrub components of rangeland are eliminated and multi-aged stands of aspen no longer dominate the landscape. If left unchecked, juniper invasion into prime mule deer habitats will have a significant negative effect on these preferred browse species.

Water quality and quantity are also affected by increased juniper encroachment. As tree density increases and understory vegetation decreases, there is a potential for increased soil erosion which can lead to increased sediment loading in the streams and water bodies. The Phase 2 and 3 juniper stands utilize more soil moisture needed to sustain the understory vegetation. In years of low precipitation, the invasive trees take up more soil moisture, which in turn can cause decreased stream flows and irrigation water shortages, along with less water for beneficial plants, livestock and wildlife.

The juniper woodlands on mule deer winter range in Lake County comprise approximately 69,300 acres. Areas along the foothills of the Warner Mountain range between Summer Lake and Goose Lake basins have experienced the greatest expansion of juniper. Controlling the early- and mid-succession stages of juniper growth in these areas will have the greatest influence on wildlife habitat by maintaining the shrub and herbaceous plant components of this ecosystem. These areas have the greatest amount of private lands where NRCS, and the local and State agency stakeholders, can work to have the greatest impact on controlling the spread of juniper.

GOALS AND OBJECTIVES

The objective of this project is to improve mule deer wintering habitat by changing the plant composition of the landscape to one less dominated by juniper. Future conditions will reflect a change in invading juniper by reducing the acreage within the transition zones between pine forest and valley bottoms.

Goal: Treat 6,000 acres of Phase 1 and 2 junipers on private lands to improve mule deer wintering habitat by restoring bitterbrush, mountain mahogany, and aspen stands. In combination with other mule deer management actions, these habitat improvements are expected to result in increased numbers of mule deer in Lake County.

Juniper control projects for mule deer habitat improvement should be directed to those areas in or immediately adjacent to the key habitat components of bitterbrush, mountain mahogany, and aspen

stands. Understory grass and shrub components, especially bitterbrush and sagebrush, will be enhanced by controlling encroaching juniper trees. Mountain mahogany stands will have juniper removed to improve plant vigor and productivity. Aspen groves, another important component of mule deer habitat, will progress from single-aged to multi-aged tree stands that are more viable due to increased soil moisture availability.

Desired future outcomes, within the next five years, include improved production from beneficial perennial grasses, forbs and shrubs for wildlife habitat. It is predicted that a reduction in juniper and an increase in desirable perennial plants will have a direct correlation to increased mule deer population and fawn survival rates, as determined by our State wildlife agency partner. In light of the ODFW Mule Deer Initiative, NRCS will place a higher priority on treatments within the Warner WMU.

Measurable outcomes will primarily result in having productive ecological sites (>1,000 lbs/ac/yr) that support mainly grasses, forbs, and shrubs are free of encroaching juniper and are managed to provide adequate forage for deer. Secondary to this outcome will be to have some productive ecological sites still in the early stage (Phase 1) of juniper encroachment, but exhibiting the desirable species of grasses, forbs, and shrubs. An unacceptable outcome will be to have juniper stands in Phase 2 transforming to Phase 3 with no understory of desirable herbaceous or shrub species.

ALTERNATIVES

There are three alternatives to be considered:

- No action
- Juniper management with prescribed fire
- Juniper management with mechanical control and slash treatment

Taking a “No Action” approach appears to be an unacceptable solution to the problem. With an absence of fire in this ecosystem, juniper will continue to invade this area until the understory shrub and herbaceous components are eliminated, making the land unproductive for both wildlife and livestock.

Considering the second alternative, utilizing prescribed fire as a juniper management tool is not readily accepted by private landowners due the liability issues involved. Since the watershed includes U.S. Forest Service, Fremont National Forest, public lands that border most of the private inholdings, the threat of a prescribed burn moving onto the publicly owned lands is too great a risk. Another problem with a landscape burn is temporary loss of habitat for game animals; the shrub component could be lost, especially bitterbrush that will not tolerate fire.

The third choice is to mechanically control the juniper by cutting down the trees and disposing of the slash by piling and burning or lopping and scattering. This method has been widely used on other juniper management projects in the county. The benefits of this mechanical control and slash treatment are less impact of the shrub and herbaceous understory and minimal soil disturbance.

As with any projects involving NRCS technical and financial assistance, National Environmental Policy Act (NEPA) concerns will be addressed through environmental evaluations that include cultural resources and threatened and endangered species reviews. Under the third alternative, when wheel-type or track-type equipment is used to pile or chip the slash, ground disturbance can be kept to a minimum when the soil surface is dry.

PROPOSED SOLUTIONS AND ACTIONS

The acceptable alternative, number three, is to initiate an accelerated program to mechanically control juniper encroachment in the early stages (Phase I and II) where the beneficial shrub component is still abundant. Taking 'No Action' will not meet the goal of stopping the spread of juniper, and using prescribed fire is not readily accepted by the private landowners due to liability issues, plus the fact that understory shrubs could be eradicated.

The most economical method will be to cut down the trees using chainsaws, and then piling the slash for burning or lopping and scattering the limbs and using the boles for firewood or fence posts. Where equipment can easily access a site, trees may be disposed of by chipping for biomass energy production at a new plant under construction in Lakeview.

Aspen and mountain mahogany groves on private lands will have juniper removed to conserve moisture and promote stand regeneration. The juniper trees removed from these sites will again have the slash piled and burned, used for firewood or posts, or chipped for biomass production.

The primary NRCS conservation practices that will be used include:

- Brush Management (314) will be implemented by mechanical control methods to cut or shear the trees at ground surface level. Cutting with chain saws will be the most typical method used.
- Forest Slash Treatment (384) will be utilized for piling cut trees and slash to reduce fuel loads in Phase II treated stands. Slash will either be burned within two years or chipped for biomass.
- Range Planting (550) may be used to re-establish native perennial vegetation, especially where Phase II juniper stands have depleted understory species.
- Upland Wildlife Habitat Management (645) will be incorporated into all plans as a primary management tool for mule deer habitat enhancement.
- Fence (382) and/or Access Control (472) can be incorporated into plans as temporary measures to control over-browsing in treated aspen stands while regeneration occurs.
- Obstruction Removal (500) may be needed to remove unwanted fences in heavily used winter deer range areas.

PARTNERSHIPS AND FUNDING SOURCES

Potential partners for this project include the Lake County Umbrella Watershed Council, Oregon Department of Fish and Wildlife (ODFW), Lakeview Soil and Water Conservation District (SWCD), Natural Resources Conservation Service (NRCS), U.S. Forest Service (USFS), and private landowners.

The Watershed Council has worked on juniper control projects in these areas in the past and is currently seeking Oregon Watershed Enhancement Board (OWEB) grants to assist more landowners. ODFW has a major part in promoting this project to benefit the mule deer population and will contribute both technical assistance and financially, with "Access and Habitat" funding.

NRCS will work with private landowners and operators to contract for cost share funding through current Farm Bill programs. At current values, based on treating 5,000 acres or 100 percent of the targeted area, it is estimated the project would cost between $850,000 and $1,300,000; the NRCS portion of the project cost would range between 50 and 75 percent of the total. Appendix A and B show the projected technical and financial assistance funds needed, by fiscal year, to contribute to the success of the project.

IMPLEMENTATION

The priority areas for juniper treatment in the Warner WMU will range from the foothills of the Goose Lake Valley towards the west into Drews Valley along the fringe areas surrounding Drews Reservoir and along the western and eastern foothills of the Warner Mountains. Secondary treatment areas will include those northward through Crooked Creek Valley, along the foothills between Valley Falls and Paisley progressing to the south end of Summer Lake on mule deer winter range in the Interstate WMU. These areas are targeted because of the heavy encroachment of juniper, and because these areas experience heavy deer use in winter where bitterbrush is abundant in the understory.

Priority landowners are those who have already incorporated juniper management into their operations by working with the Watershed Council, NRCS, or other partners in the past and are willing to implement additional brush management on their rangelands. These landowners recognize the value in controlling large blocks of juniper to benefit wildlife and improve grazing for their livestock enterprises. By continuing to work with owners of large landholdings, we can demonstrate the benefits of juniper control to owners of smaller acreages and eventually involve them in this implementation strategy.

With assistance from the Watershed Council and ODFW, NRCS will implement this project through EQIP and/or WHIP contracts with landowners and operators. It is estimated the targeted acreage can be treated within a five year timeframe, with involvement from eight to twelve private landowners and operators. The NRCS and SWCD will conduct an outreach program to promote this watershed scale project during annual Farm Bill program application signup periods. The U.S. Forest Service is implementing a program to improve the aspen stands on public land throughout this watershed, and may be able to assist across land ownership boundaries, if only in a technical capacity.

Following the brush management practice of mechanical juniper control, a walk-through will be required in the cut areas to scout for any missed trees or uncut lower branches on stumps. If these conditions exist, the landowner or contractor will be required to return to the area for follow-up treatment to remove trees and branches that were left.

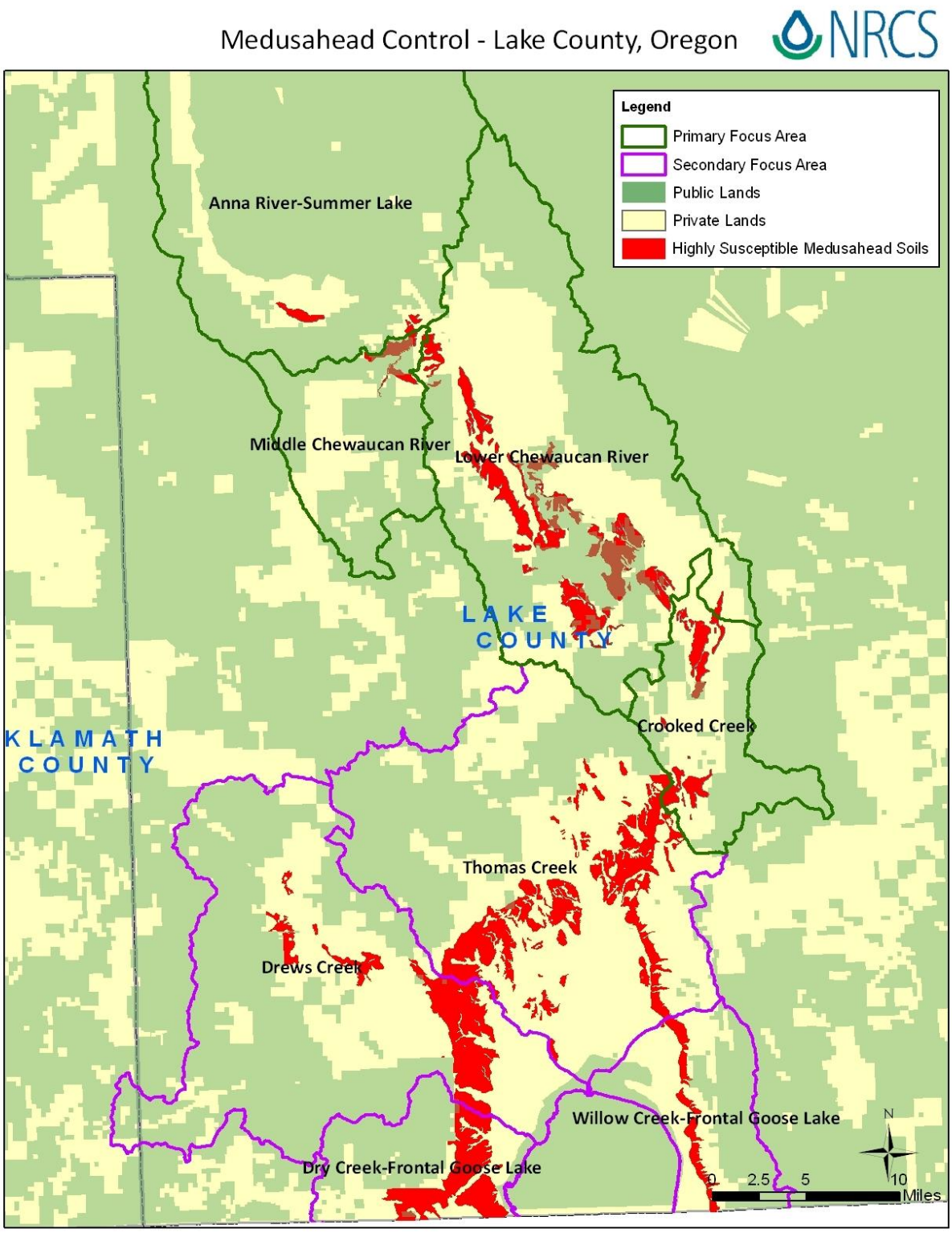
PROGRESS EVALUATION AND MONITORING

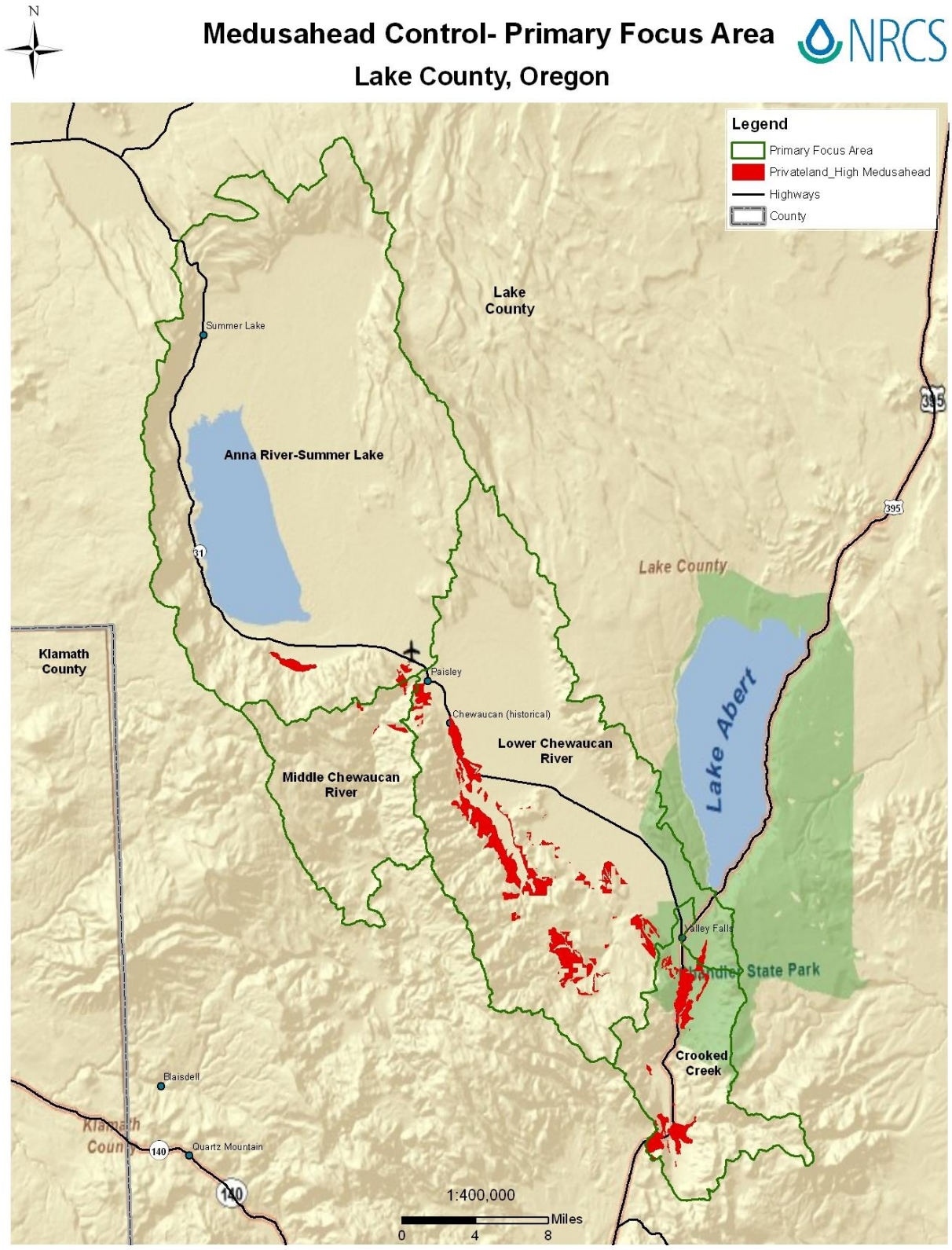
The progress and success of this implementation strategy can be measured first and foremost by the amount of juniper-infested acres treated. The project would still be considered successful if 90-95 percent of the 6,000 acres targeted receive treatment within the five year timeframe.

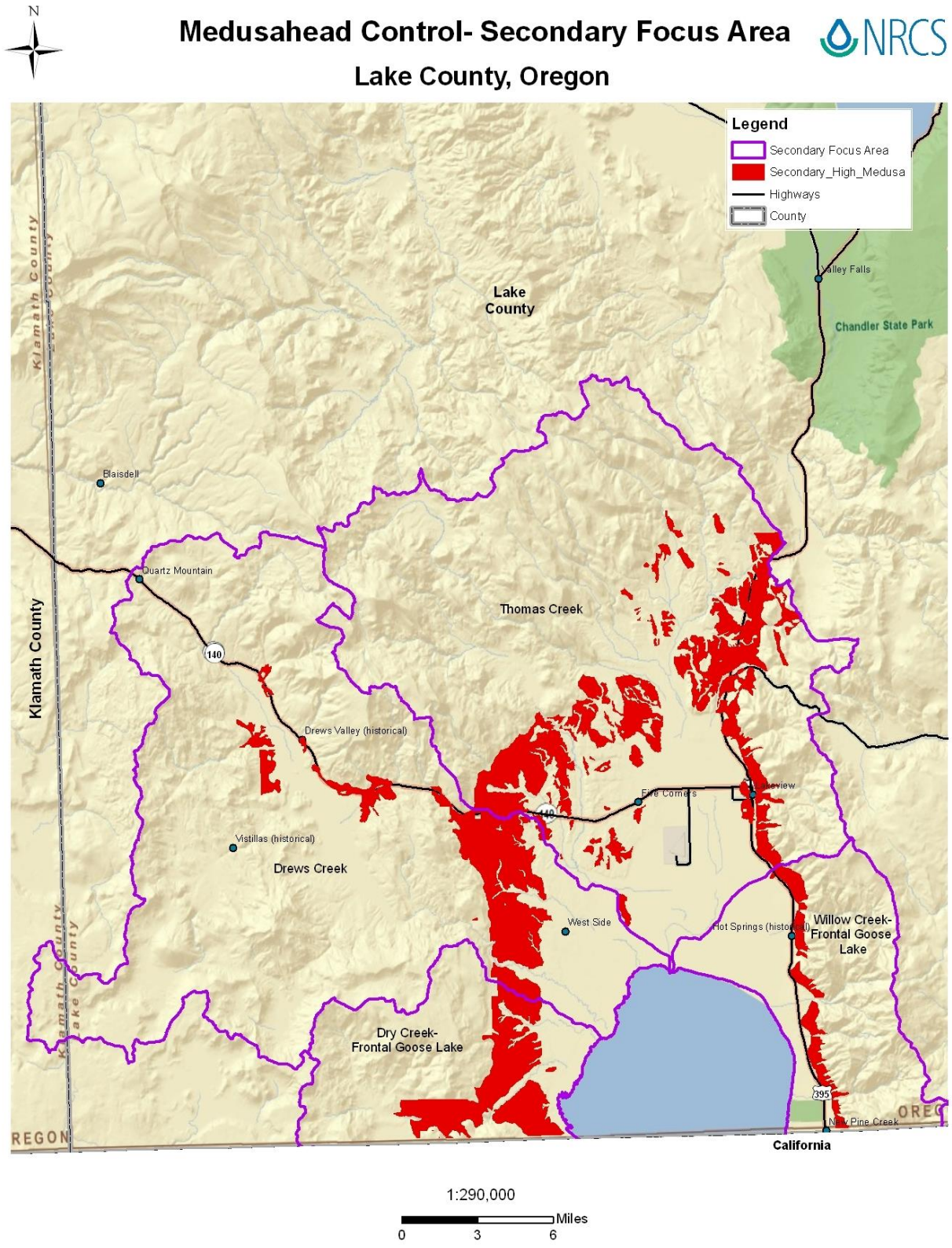
Annual reports to the partners regarding acres treated can track the progress towards the final goal. In 2012, contracts through the Environmental Quality Incentives Program (EQIP) were entered into with five private landowners for 1,911 acres of juniper control under this implementation strategy.

Yearly measurements will be conducted to record changes in species composition, hopefully the increase in shrub and herbaceous cover. Regeneration of juniper can mark the success or failure of the project through yearly monitoring of the treated areas by NRCS and the partners. Follow-up treatments can be determined by these monitoring efforts and help to establish long-term objectives for controlling encroachment of juniper into treated and untreated areas.

Medusahead Control on Rangeland in Southern Lake County




N
Medusahead Control- Primary Focus Area
Lake County, Oregon
NRCS
Legend
Primary Focus Area
Privateland_High Medusahead
Highways
County
Lake County
Summer Lake
Anna River-Summer Lake
Klamath County
Paisley
Chewaucan (historical)
Lower Chewaucan River
Middle Chewaucan River
Lake Abert
Lake County
Valley Falls
Crooked Creek
Blaisdell
Quartz Mountain
140
31
395
1:400,000
Miles
0
4
8


N
Medusahead Control- Secondary Focus Area
Lake County, Oregon
NRCS
Legend
Secondary Focus Area
Secondary_High_Medusa
Highways
County
Lake County
Klamath County
Valley Falls
Chandler State Park
Blaisdell
Quartz Mountain
Thomas Creek
140
Drews Valley (historical)
Fire Corners
Lakeview
Vistillas (historical)
Drews Creek
West Side
Hot Springs (historical)
Willow Creek-
Frontal Goose
Lake
Dry Creek-
Frontal Goose Lake
395
Nut Pine Creek
California
1:290,000
Miles
0
3
6

In 2010, the Lake County Local Working Group identified invasive species and noxious weeds as a high priority resource concern. This was incorporated into the NRCS Long Range Strategic Plan as a resource problem to be addressed. Of particular concern was the spread of annual grasses on private and public grazing lands; specifically this focused on the invasion of medusahead on rangeland in the southern half of Lake County. Soils with surface textures higher in clay content are more susceptible to medusahead invasion. In Lake County these soil types are more prevalent in the Goose Lake, Lake Abert, and Summer Lake Basins (see map, page 1).

OVERVIEW/BACKGROUND

Medusahead (*Taeniatherum caput-medusae*) is an aggressive, winter annual grass which is adversely changing the ecology of Oregon rangelands; native habitat has been lost and many native species displaced. It was first discovered growing in Oregon in the late-1800's. Medusahead germinates mainly in the fall, although winter and spring germination occurs with favorable environmental conditions. The seeds are covered with spiny barbs that are dispersed by becoming attached to animals, humans, and vehicles as they pass by. As medusahead spreads, it out-competes native grasses by depleting soil moisture well before cool-season, perennial grasses have begun to grow.
Medusahead creates a dense layer of litter, and because of high silica content, the litter decomposes slower than that of other plants. This litter changes the temperature and moisture dynamics of the soil, further suppressing native plant growth while encouraging the germination of its own seed. After a few years, the litter creates an enormous fuel load that can lead to devastating wildfires. Post-fire conditions allow for extensive monocultures of medusahead. Carrying capacity of land infested with medusahead can be reduced by up to 75 percent. Wildlife habitat and biodiversity also suffers as species, such as mule deer and sage grouse, tend to avoid areas overrun with medusahead due to its limited feed value and digestibility, along with the potential injury from its awns and seeds. Prevention, control of small infestations, and containment of larger ones is imperative, otherwise the future environmental and economic impacts will be devastating.

PROBLEM STATEMENT

In Lake County, medusahead is well established on grazing lands in areas west of Valley Falls and south of Paisley. The majority of past treatments for medusahead have been focused within these infested areas. However, in 2002 and 2004 wildfires burned a significant portion of the rangelands on Winter Rim along the western edge of Summer Lake and along the foothills south of Paisley. In the years following these fires, land managers have detected numerous patches of medusahead developing within the area. Other areas with heavy-textured soils, highly susceptible to medusahead invasion, are along the western and southern edges of Summer Lake and in the foothills ringing the Goose Lake Basin. These areas most susceptible, with loam, clay loam and silty clay loam surface texture soils, are in the 14-18 inches annual precipitation zone on benches and wave-cut terraces on foothills and mountains. Map units of soil series affected include: Booth, Bullump, Chewaucan, Deter, Drews, Lasere, Lorella, Nuss, Oxwall, and Salisbury.

Under this implementation strategy, NRCS will focus on providing assistance to private landowners who have medusahead infestations on their rangeland in the Summer Lake, Valley Falls, Paisley, and Goose Lake areas. The primary focus will be in the Summer Lake, Valley Falls, and Paisley areas (see map, page 2). There are approximately 15,100 acres of highly-susceptible soils within this focus area on rangeland. Sub-watersheds targeted for treatment include Anna River-Summer Lake, Middle Chewaucan River, Lower Chewaucan River, and Crooked Creek.

A secondary focus will be treatments in the Goose Lake basin; private rangeland with highly-susceptible soils in this area comprise approximately 45,830 acres (see map, page 3). Sub-watersheds for this area include Thomas Creek, Drews Creek, Dry Creek-Frontal Goose Lake, and Willow Creek-Frontal Goose Lake. Infestations are not extensive in this area at present, although small areas have been identified by local weed management officials and state wildlife biologists that will become larger problems if left unchecked.

Grazing lands under the jurisdiction of the Bureau of Land Management (BLM) in these focus areas are also infested, or have the potential of being infested, with medusahead. Highly susceptible soils on public lands comprise 7,393 acres in the primary focus area and 500 acres in the secondary focus area. Due to a court injunction, Lakeview Area BLM managers are unable to control medusahead invasion with herbicides. Consequently, no treatment efforts have been accomplished in recent years to halt the spread of this invasive annual from public to private lands. Minimal cooperation between BLM, NRCS, and private landowners is anticipated under this implementation strategy until a final ruling by the courts on this restricted use of pesticides on the public lands.

NRCS will partner with the Lake County Cooperative Weed Management Area (CWMA), Lake County Umbrella Watershed Council, Lakeview and Fort Rock-Silver Lake Soil and Water Conservation Districts (SWCD's), and state and federal agencies to achieve integrated pest management within these focus areas.

GOALS AND OBJECTIVES

The main objectives are for landowners to adopt and implement integrated pest management, to decrease the expansion of this invasive species, and to reduce the acres of medusahead on highly-susceptible soils in the focus areas.

Goal: Cooperate with twelve landowners in the primary and secondary focus areas to treat 7,000 acres of medusahead within the next five years (2013-2017).

The desired future condition will primarily be to have medusahead absent or sufficiently controlled to allow adequate quantities of desirable perennial plants to be present for livestock grazing and wildlife habitat. Establishment of 2-5 perennial grass and/or forb plants per square meter after seeding will determine success in meeting the desired condition.

ALTERNATIVES

The alternatives to be considered for this implementation strategy are:

- No Action
- Integrated Pest Management with Range Plantings

The No Action alternative will result in no changes to current land management practices. Landowners are not likely to aggressively treat medusahead infestations because the cost of treatment is high and conventional treatments have been relatively ineffective. The expected impacts include rapid expansion of medusahead rye, which will lead to increased fire frequency and intensity and conversion of rangelands from diverse native vegetation to monocultures of annual grasses. This will result in lost forage production on uplands, leading to increased grazing pressure on riparian areas within the focus area.

As medusahead expands in the uplands, surface runoff and erosion will increase resulting in soil loss, down cutting of streams and degradation of water quality. These effects will negatively impact wildlife habitat for both terrestrial and aquatic wildlife, as well as the economic viability of agricultural operations. The No Action Alternative is a high risk alternative for private landowners in the long-term, potentially resulting in significant reductions in profitability and social well-being.

The Integrated Pest Management (IPM) alternative is a sustainable approach to pest control that combines the use of prevention, avoidance, monitoring and suppression strategies, to maintain pest populations below economically damaging levels, to minimize pest resistance, and to minimize harmful effects of pest control on human health and environmental resources. IPM suppression systems include biological controls, cultural controls and the judicious use of chemical controls. The expected impacts include prevention of the spread of medusahead and a reduction in the total acreage of medusahead within the focus areas. Plant productivity, health and vigor will improve on rangelands as a result of control of medusahead, revegetation with desirable species, and prescribed grazing. These improvements to plant condition will result in increased forage availability and improved wildlife habitat.

This is a high risk alternative in the short-term and a moderate risk alternative in the long-term. The high short-term risks are associated with the high cost of IPM techniques, increased labor, and significant changes to management levels. In addition, all weed control efforts have an inherent risk of failure although IPM offers the greatest probability for success. Landowners will continue to face moderate risks in the long-term as there are continued costs associated with monitoring and maintenance as well as a sustained need for increased labor and management levels. However, this alternative is the lowest risk alternative in the long-term.

As with any projects involving NRCS technical and financial assistance, National Environmental Policy Act (NEPA) concerns will be addressed through environmental evaluations that include cultural resources and threatened and endangered species reviews.

PROPOSED SOLUTIONS AND ACTIONS

Utilizing Integrated Pest Management is the acceptable method of controlling the invasion of medusahead in the focus areas. By implementing scouting, treatment with herbicides, reseeding with native or introduced perennial herbaceous species, and monitoring for success, we can control the spread of medusahead on grazed range. Taking No Action will not meet the goal of stopping the spread of medusahead.

The most economical treatments will be to apply recommended herbicides by aerial methods using proper rates and timing, followed by no-till rangeland seedings of recommended native and introduced species. The primary NRCS conservation practices that will be used include:

- Herbaceous Weed Control (315) will be implemented by chemical methods to control the new growth and establishment of medusahead. Aerial application of herbicides will be the most typical method used.
- Range Planting (550) will be used to re-establish or interseed native or introduced grasses, forbs, or legumes into areas following the herbaceous weed control practice.
- Access Control (472) can be incorporated into plans as a temporary measure to control livestock access to areas of weed control and seedings.
- Fence (382) will be implemented as temporary or permanent barriers to treatment areas to control livestock grazing.
- Prescribed Grazing (528) will be implemented to maintain and improve the health and vigor of desired perennial grasses, forbs, and shrubs.

PARTNERSHIPS AND FUNDING SOURCES

The major partner for this project is the Lake County Cooperative Weed Management Area (CWMA). The coordinator has started negotiations with landowners in the Summer Lake area to implement projects in 2013. The CWMA has asked for NRCS technical and financial assistance to implement the herbaceous weed control and range plantings.

Other partners include Oregon Department of Fish and Wildlife (ODFW), Lake County Umbrella Watershed Council, Lakeview and Fort Rock-Silver Lake Soil and Water Conservation Districts (SWCD's), and private landowners. ODFW will play an important role in promoting this implementation strategy to benefit upland big game and bird populations and habitat. They will contribute both technical and financial assistance to the project.

NRCS will work with private landowners and operators to contract for cost share funding through current Farm Bill programs. At current values, based on treating 7,000 acres or 100 percent of the targeted area, it is estimated the project would cost $1,132,000 to $2,249,000; the NRCS portion of the project cost would range between 50 and 75 percent of the total. Appendix A and B show the projected technical and financial assistance funds needed, by fiscal year, to contribute to the success of the project.

IMPLEMENTATION

There will be primary and secondary focus areas for this medusahead control project. Highest priority will focus on projects in the primary areas of Summer Lake, Valley Falls, and Paisley where landowners have partnered with the CWMA or ODFW and are willing to contract with NRCS. The secondary focus will be working with landowners in the Goose Lake basin on the highly-susceptible medusahead soils

long the eastern and western foothills. These areas may rank high based on medusahead invasion, but will be treated after areas in the primary focus areas.

With assistance from the partners, NRCS will implement this project through EQIP contracts with landowners and operators. It is estimated the targeted acreage can be treated within a five year timeframe with involvement from at least ten private landowners. NRCS, in cooperation with the CWMA coordinator and SWCD staff, will conduct an outreach program to promote this project during annual Farm Bill program application signup periods.

PROGRESS EVALUATION AND MONITORING

The progress and success of this implementation strategy can be measured overall by the amount of medusahead infested acres treated. The project will still be considered successful if 90 percent of the 7,000 acres targeted receive treatment within the five year timeframe. Annual reports to the partners regarding acres treated can track the progress towards the final goal.

Annual measurements will be conducted to record changes in species composition, hopefully with an increase in perennial herbaceous cover. Regeneration of medusahead can mark the success or failure of the project through yearly monitoring of the treated areas by NRCS and the partners. Follow-up treatments can be determined by these monitoring efforts and help to establish long-term objectives for controlling encroachment of medusahead into treated and untreated areas. Achieving a plant density of 2-5 desired perennial species per square meter plot two to three years following the last treatment activity will also be used to determine project success.

Monitoring will be completed by NRCS and SWCD personnel during annual status reviews while contracts are active; standard NRCS range inventory protocols will be used to determine species composition and percent cover of perennial plants. Photo points will be established and monitored by the landowners, CWMA Coordinator, NRCS, SWCD, and ODFW to record changes in species composition over a longer period of time, well after contractual agreements have ended. ODFW Biologists will assist in monitoring the benefits of medusahead management through wildlife counts to determine changes in species populations, especially in greater sage grouse core areas.

Working Lands Habitat Conservation for Waterfowl: Enhancing and Protecting Surface-Irrigated Fields to Meet Spring Migration Habitat Objectives in the Pacific Flyway

Background

The Pacific Flyway is a major north-south route of travel for migratory birds in western North America. Within the Flyway, the Southern Oregon-Northeastern California (SONEC) region is an area of continental significance for waterfowl, serving as a major fall and spring staging area during migration (North American Waterfowl Management Plan, Fleskes and Yee 2007). During southward migration in the fall, ducks, geese, shorebirds, and wading birds (collectively referred to here as '*waterbirds*') rely on the region's wetlands to feed and rest before continuing on to their primary wintering areas in the Central Valley of California, coastal California and Mexico, and interior wetlands of Mexico. This pattern is reversed in the spring and many of the same birds pass through the region on their northward migration to the Canadian prairies and Alaska. As a spring staging area, the SONEC region plays a critical role in the lifecycle of Pacific Flyway waterfowl. Some of the notable spring migrants through the SONEC region include 33% of continental population of Northern Pintails, over 80% of the western population of Tundra Swans, and over 50% of the Pacific Flyway's Greater White-Fronted Geese (Fleskes and Yee 2007, IWJV unpublished data).The region is vitally important for female waterfowl that rely on staging habitat to improve body condition and build energy stores required for migration to northern breeding areas. Birds arriving on breeding areas in better body condition have higher breeding success and productivity. Thus, habitat conditions in SONEC can influence breeding performance in other regions of North America.

Figure 1. High priority wetland habitats in the Intermountain West identified in black, including Southern Oregon-Northeastern California (SONEC) Region, Great Salt Lake and Columbia Basin Ecosystems.

The SONEC region is especially critical for early-nesting species such the Northern Pintail, a high priority species identified by the North American Waterfowl Management Plan (NAWMP) due to its suppressed population status. The majority of SONEC's natural and human-induced emergent wetland habitat occurs on private lands. Thus, private land conservation has a critical role in ensuring the long-term viability of the resident and migratory species.

Historically, extensive flooding occurred in the spring following runoff of snowmelt producing large areas of seasonal wetlands adjacent to waterways. Much of the natural hydrologic cycle has been altered by dams and waterway diversions for human and agricultural use. Natural flooding has been replaced by human-induced flooding for agricultural production purposes which largely mimics the natural cycle and continues to provide many of the wetland benefits previously supplied.

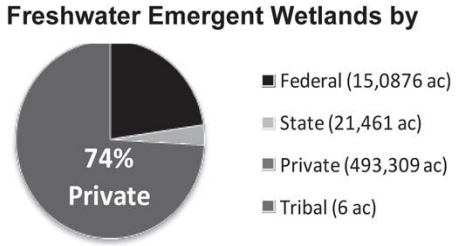


Figure 2. Percent ownership of freshwater emergent wetlands in the SONEC region.

Recent science from U.S. Geological Survey (USGS) and the Intermountain West Joint Venture (IWJV) has revealed the relative importance of flood-irrigated pastures, hay lands, and wet meadows in this region for meeting non-breeding waterfowl habitat requirements in the Pacific Flyway (Fleskes and Yee 2007, Fleskes and Gregory 2010, IWJV unpublished data). Traditional agricultural practices including flood irrigation, haying, and grazing, combined with natural snowmelt runoff, creates ideal conditions for spring migratory waterbirds. In particular, short grasses with shallow ponding, often less than 12 inches in depth, produce an abundance of available seeds, invertebrates, and green vegetation for waterfowl foraging.

Problem Statement

Recent planning efforts on behalf of the IWJV have established spring migration populations objectives for the SONEC region that link back to continental population objectives of the North American Waterfowl Management Plan. The objective of 4.9 million ducks represents approximately 14% of the continental objective for principal duck species. Pintails comprise half of the total SONEC population objective.

Species	Number of Birds using SONEC During Spring
Northern Pintail	2,418,000
American Widgeon	1,140,000
Northern Shoveler	613,000
Green-Winged Teal	520,000
Gadwall	111,000
Mallard	66,000
Total	**4,868,000**

Table 1. Population objectives for principal dabbling duck species during spring migration in the SONEC region.

Field research by USGS (funded by IWJV and DU) has estimated the foraging value of flood-irrigated habitats in the SONEC region to these principal species of waterfowl. This information was used in a bioenergetics model to quantify habitat needs and conservation targets for these birds (Table 1). Within the four Oregon core sub-regions it is expected that 25% of the habitat demand for spring migrating waterfowl will be met on National Wildlife Refuges and State Wildlife Areas. In order to achieve the SONEC habitat objectives and support waterfowl populations at goal levels, private lands and principally those which are flooded irrigated will need to provide the balance (75%) of the habitat demands (Table 2).

SONEC Sub-Region	Habitat Needs (acres)
Upper Klamath	17,300
Summer Lake	8,300
Warner Valley	10,500
Malheur	5,300
Total	**41,400**

Table 2. Flood-irrigated habitat objectives (acres) required to meet food energy demands of spring migrating dabbling ducks in Oregon sub-basins of the SONEC regions.

Increasing competition for water supplies, aging infrastructure, land values, agricultural economics, and other factors make these private lands susceptible to changes in ownership and/or management practices that could negatively impact their value to waterfowl populations during migration. Protecting and maintaining these wetlands is an important strategy to sustain waterfowl populations in the Pacific Flyway and meet the goals of the NAWMP.

Loss of flood-irrigation management practices and foraging habitat in the SONEC region may have dramatic impacts to priority waterfowl populations in the Pacific Flyway such as Northern Pintail and Greater White-fronted Geese. Continued loss of these critical habitats would result in altered distribution of waterfowl during spring migration concentrating birds in less productive foraging habitats and increasing competition for food resources. As a result, birds would experience poorer body condition and be at considerable disadvantage for subsequent migration and breeding activities. Birds in poor body condition have demonstrated reduced survival and reproduction (Moon and Haukos 2006, Devries et al. 2010). Given the significance of SONEC to waterfowl populations, continental scale demographics may be influenced if appropriate habitats are not provided for these birds during spring migration.

The NRCS holds approximately 50,000 acres of WRP easements within the Oregon portion of the SONEC. These easements contain a variety of wetland and upland habitat types. Based on current estimate, approximately 22 % of these acres (11,000 acres) provide the habitat desired to meet the SONEC specific conservation objectives. In 2010 NRCS Oregon initiated a WRP Reserved Grazing Right Pilot in attempt to engage working ranches in a wetland conservation easement. The goal of the pilot was/is to secure and protect with a conservation easement the balance of the acres (approximately 30,000 acres) to reach the SONEC objectives related to surface-irrigated wetland habitat.

Interest level to date has been limited to five potential applications. Limited interest can largely be attributed to concerns for the government acquisitions of certain management rights along with the permanent nature of the easement. Discussions among conservation partners and local landowners throughout 2012 highlighted the need to consider alternatives to a solely WRP approach. The EQIP option was selected as a suitable alternative that would allow piloting the concept while eliminating the concerns related to a permanent easement.

Proposed Solutions and Actions

The intent in using EQIP will be to demonstrate the value of managing soil and/or surface water levels during the off season in order to provide seasonal habitat for migratory waterbirds. The conservation practice Shallow Water Development and Management (646) and will serve as the principle EQIP sponsored practice. A variety of vegetative practices related to habitat improvements and structural practices related to water conveyance will also be made available through EQIP.

Targeted Approach

The SONEC region is defined by 11 sub-regions (Figure 3). Previous research by USGS indicated that ninety-six percent of marked spring migrating ducks occurred within in seven core sub-regions of SONEC. Four of these core sub-regions are located entirely within Oregon, including Upper Klamath, Summer Lake, Warner Valley and Malheur Basins.

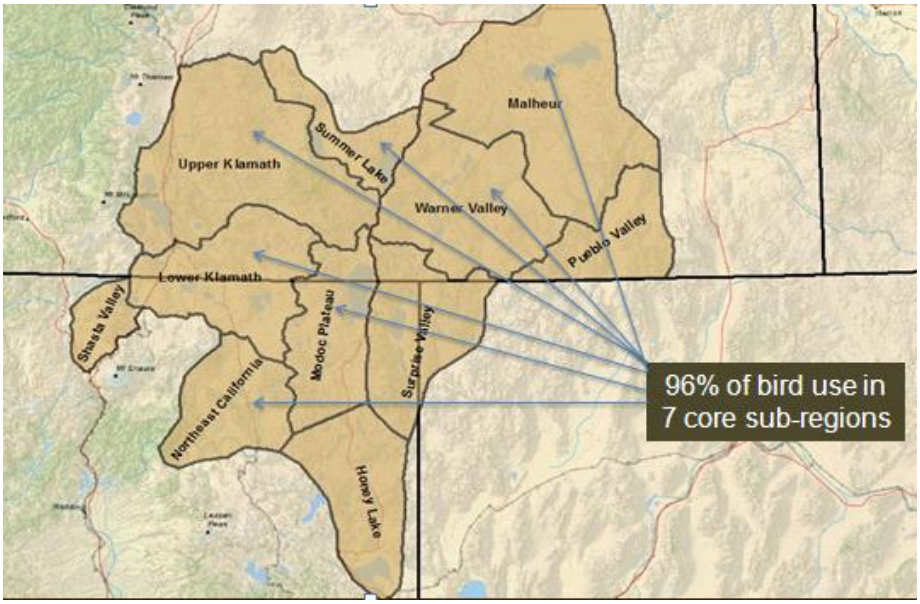


Figure 3. Distribution of the 11 sub-basins in the SONEC region.

The proposed Conservation Implementation Strategy regarding Working Lands Habitat Conservation for Waterfowl will serve as a demonstration project for NRCS and conservation

partners. This strategy will target specific habitats and land management operations in a subset of priority wetland dominated sub-basins within southern Oregon. These selected sub-basins have been identified by the IWJV as Bird Habitat Conservation Areas and correspond with primary use-areas identified by prior USGS research endeavors (Miller et al. 2005; Fleskes and Yee 2007, Fleskes and Gregory 2010). They include Upper Klamath, Goose Lake, Summer Lake/Chewaucan, Lake Abert, Warner and Harney basins (Figure 4).

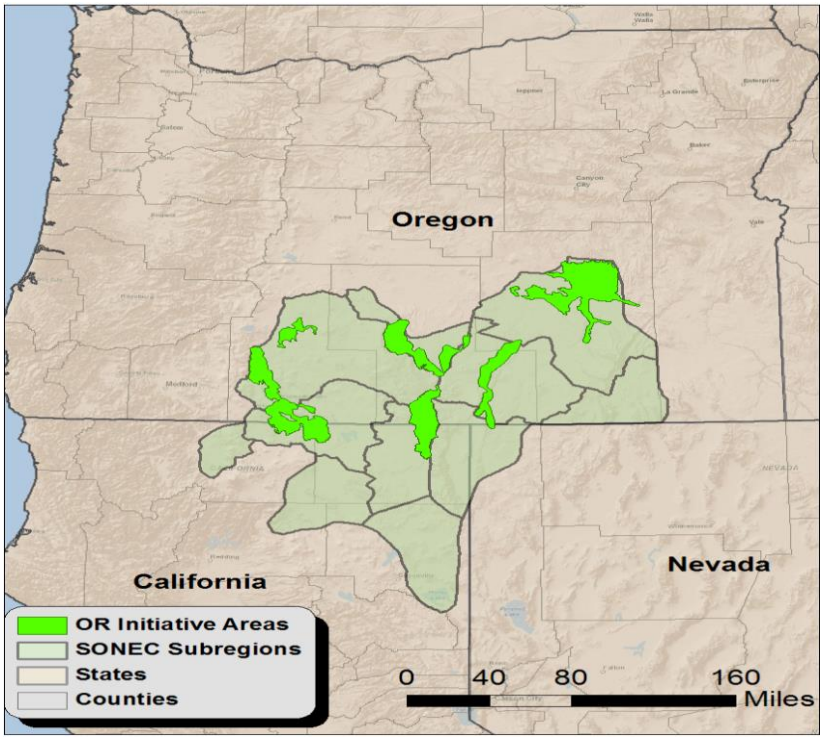


Figure 4. Targeted sub-basins within the Oregon portion of SONEC for the CIS for Working Lands Habitat Conservation for Spring Migrating Waterfowl. Selected basins include Upper Klamath, Summer Lake/Chewaucan, Lake Abert, Goose Lake, Warner Valley, and Harney basins.

The focus within in these sub basins will be on hay or pasture lands with soils suitable for creating and maintaining the desired habitat. Participation will be two fold. First, the proposed acres must include soils of low permeability and/or seasonal high water tables allowing for the maintenance of proper water levels during the late winter early spring migration period. Secondly, the proposed acres must have the ability of being flooded (naturally or induced) to targeted levels during spring migration. Application prioritization will include:

- The presence of adjacent wildlife-friendly cover or natural habitats, irregular surfaces versus smooth surfaces to create diverse plant communities.
- Diversity and extent of water bird habitat to be developed.
- Absence of conflict with water rights, ESA or other regulatory concerns.

Goals and Objectives

Goal 1: Demonstrate the value in managing soil and/or surface water levels during the off-season in order to provide seasonal habitat for migratory waterbirds.

Objective 1.1: Enhance ability to manage soil and/or surface water levels during the off-season on 3 to 4 ranches within the targeted sub-basins by 2015.

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Fleskes, J. P., and C. J. Gregory. 2010. Distribution and dynamics of waterbird habitat during spring in southern Oregon-northeastern California. Western North American Naturalist 70:26–38.

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Moon, J. A., and D. A. Haukos. 2006. Survival of female northern pintails wintering in the Playa Lakes Region of northwest Texas. Journal of Wildlife Management 70:777–783.

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Appendix: Figures and Tables

Figure 1

Long Range Plan - Lake County, Oregon
Ownership

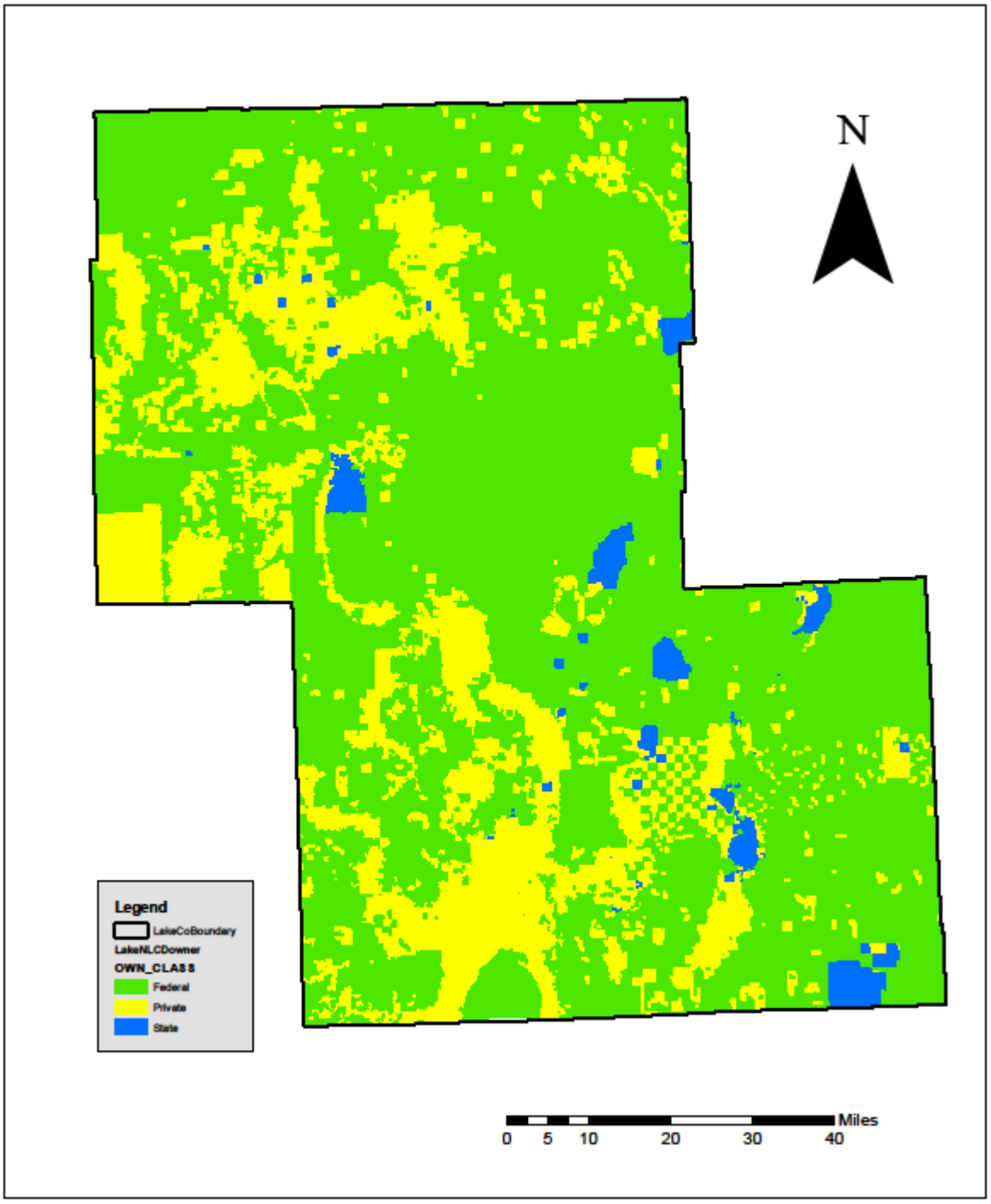


Figure 2

Long Range Plan - Lake County, Oregon
Land Cover/Land Use

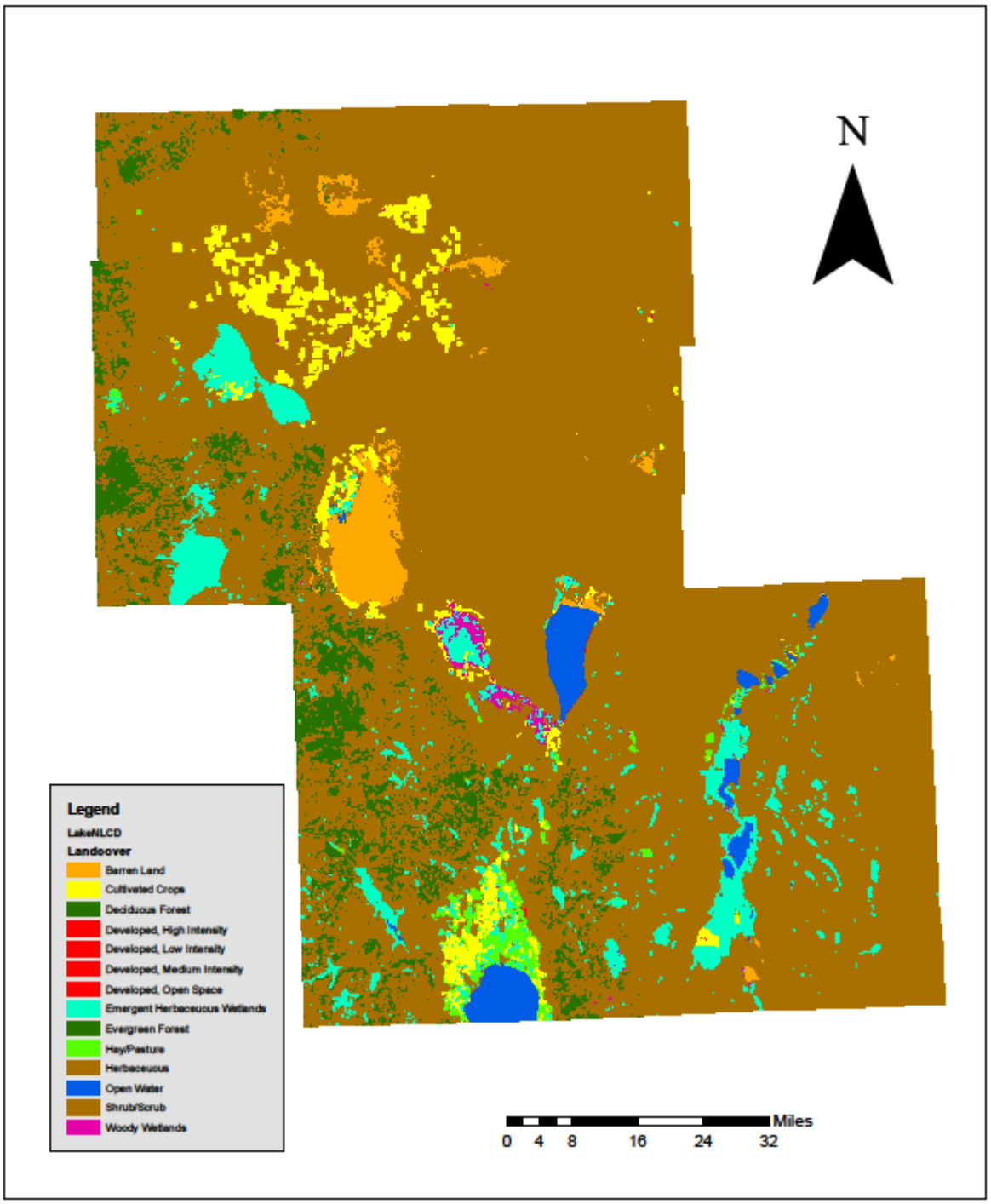


Figure 3

Long Range Plan - Lake County, Oregon
Topography and Shaded Relief

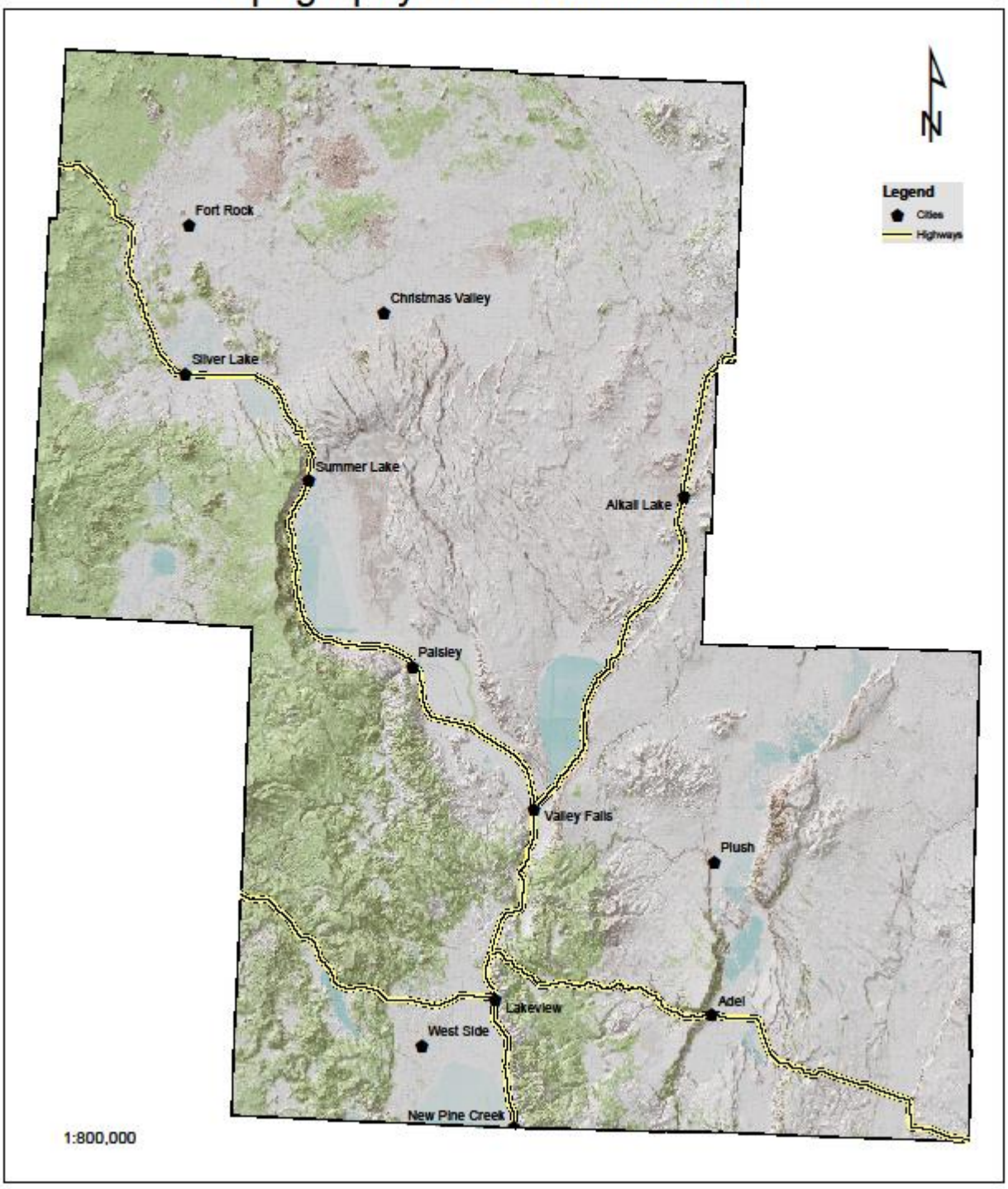


Figure 4

Long Range Plan - Lake County, Oregon
General Soils Map

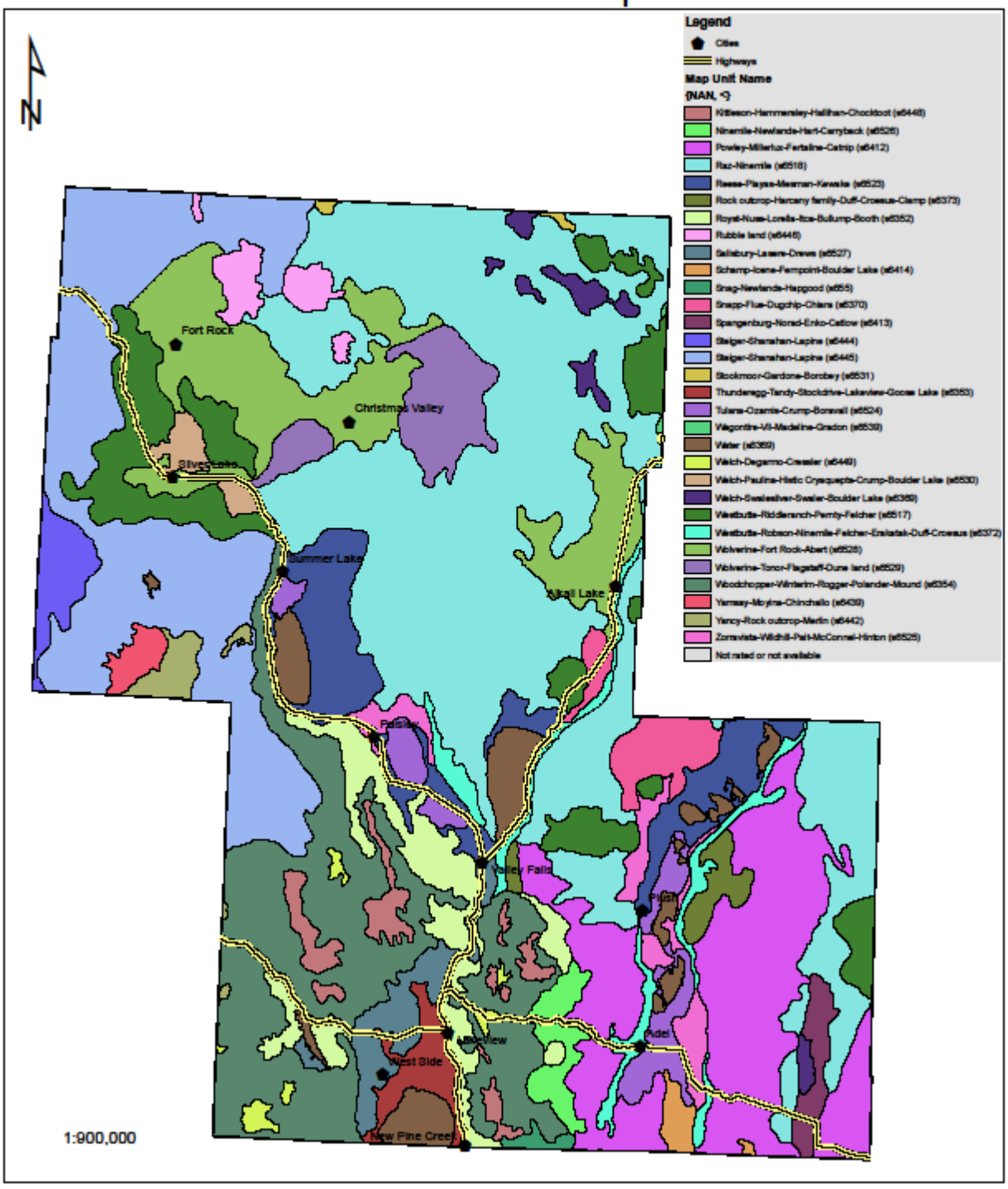


Figure 5

Long Range Plan - Lake County, Oregon
Common Resource Areas

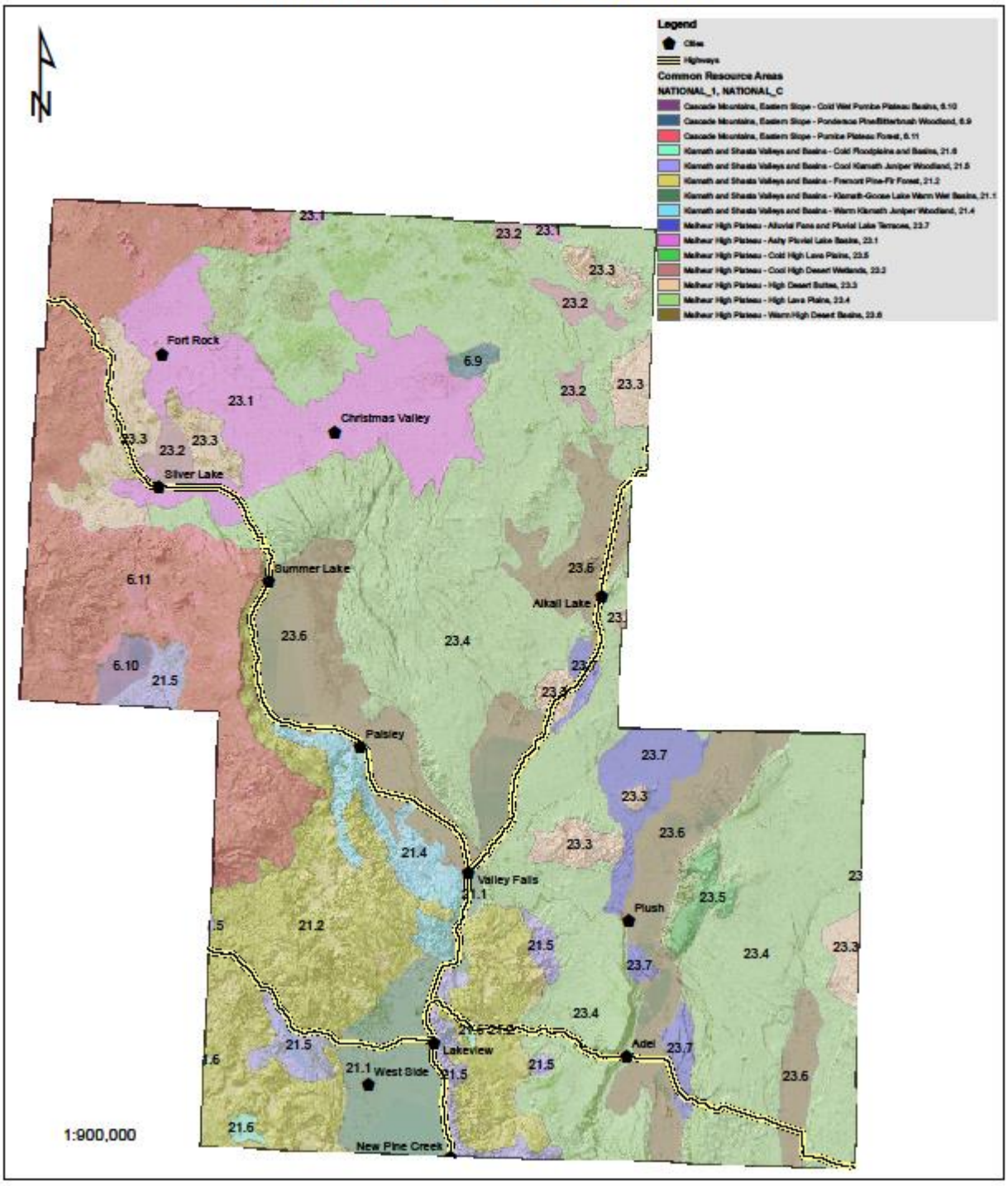


Figure 6

Long Range Plan - Lake County, Oregon
Wind Erodibility Groups

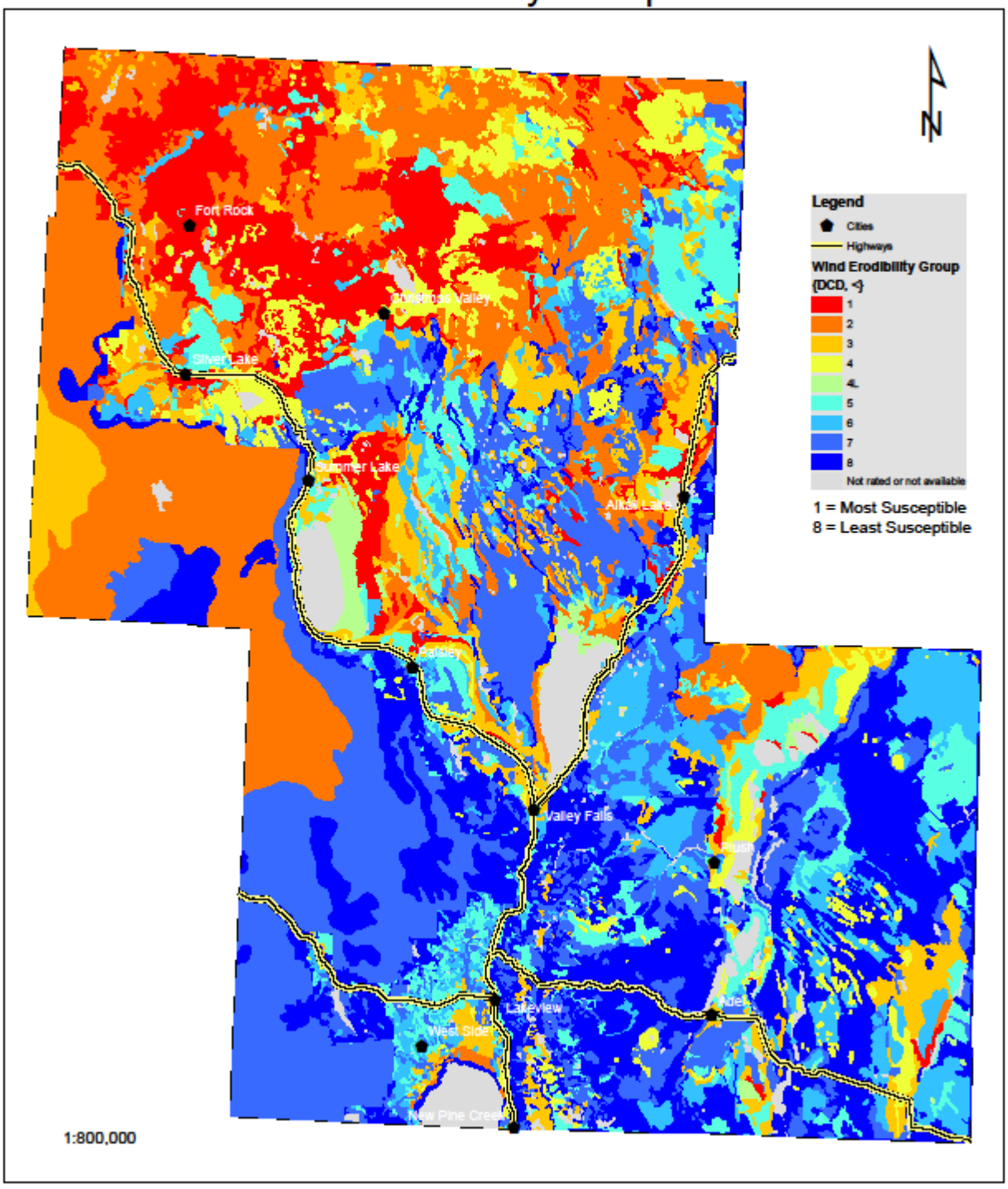
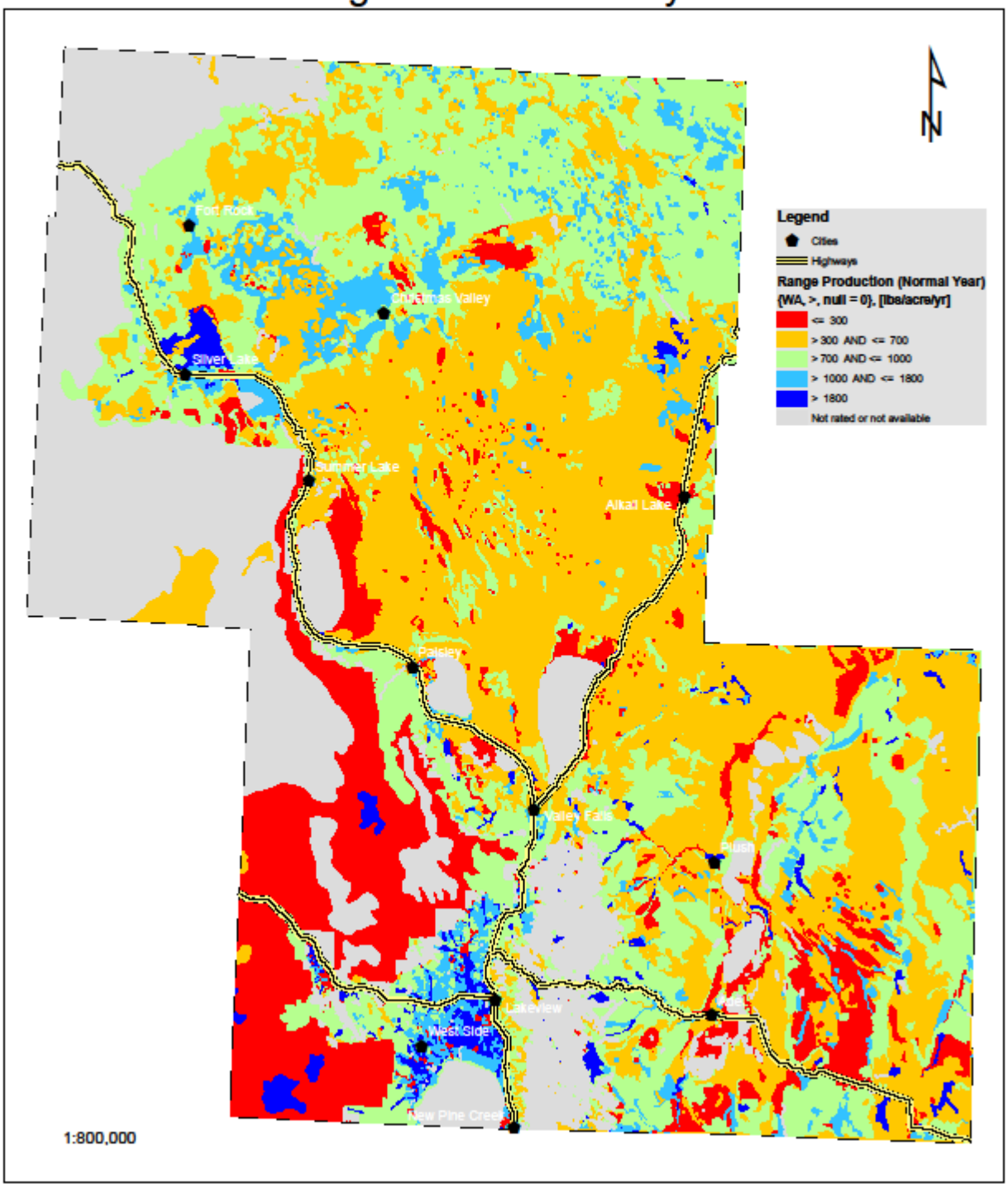


Figure 7

Long Range Plan - Lake County, Oregon
Rangeland Productivity



Long Range Plan - Lake County, Oregon
Annual Precipitation (Figure 8)

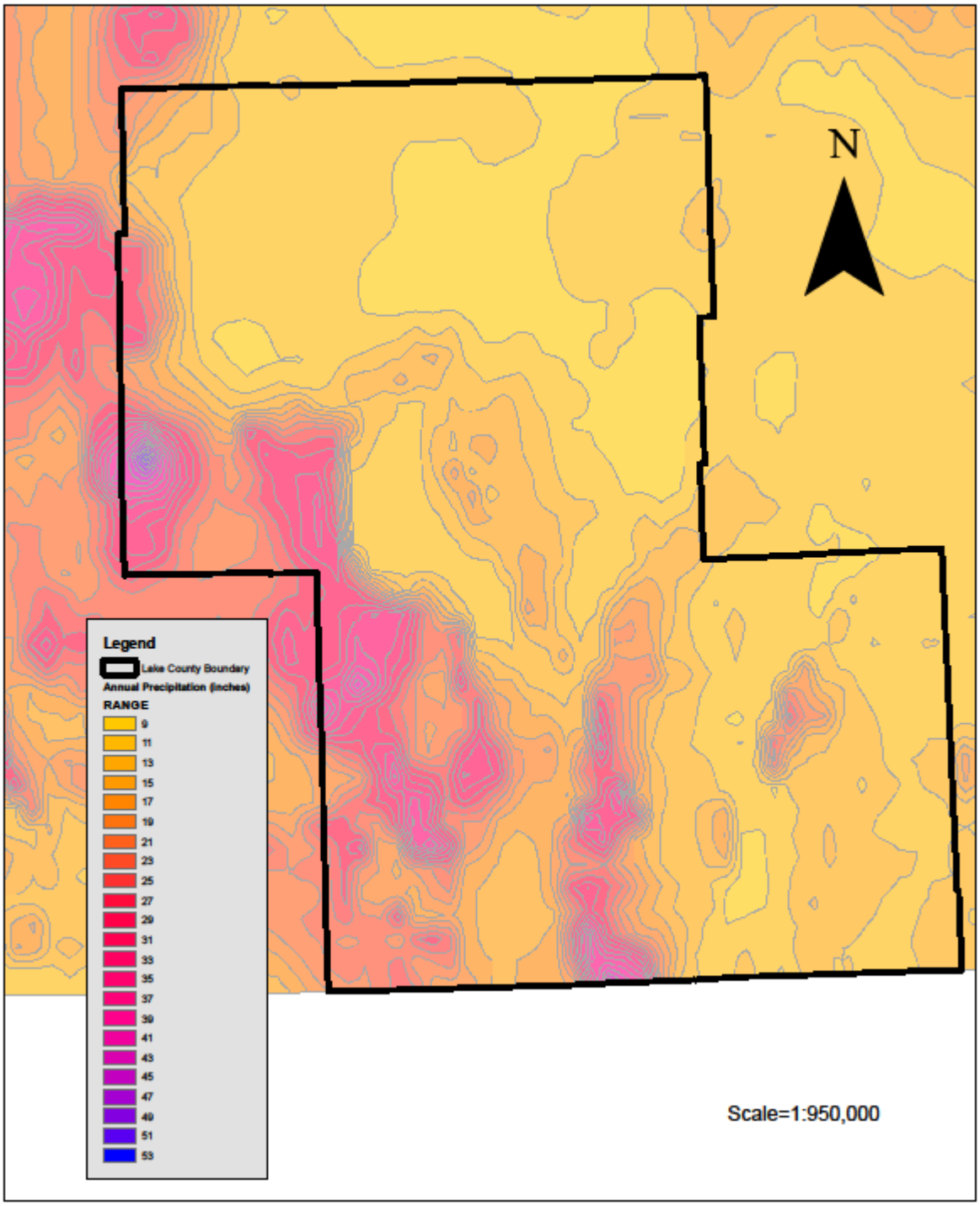


Figure 9

Long Range Plan - Lake County, Oregon
8-digit Watershed Boundaries

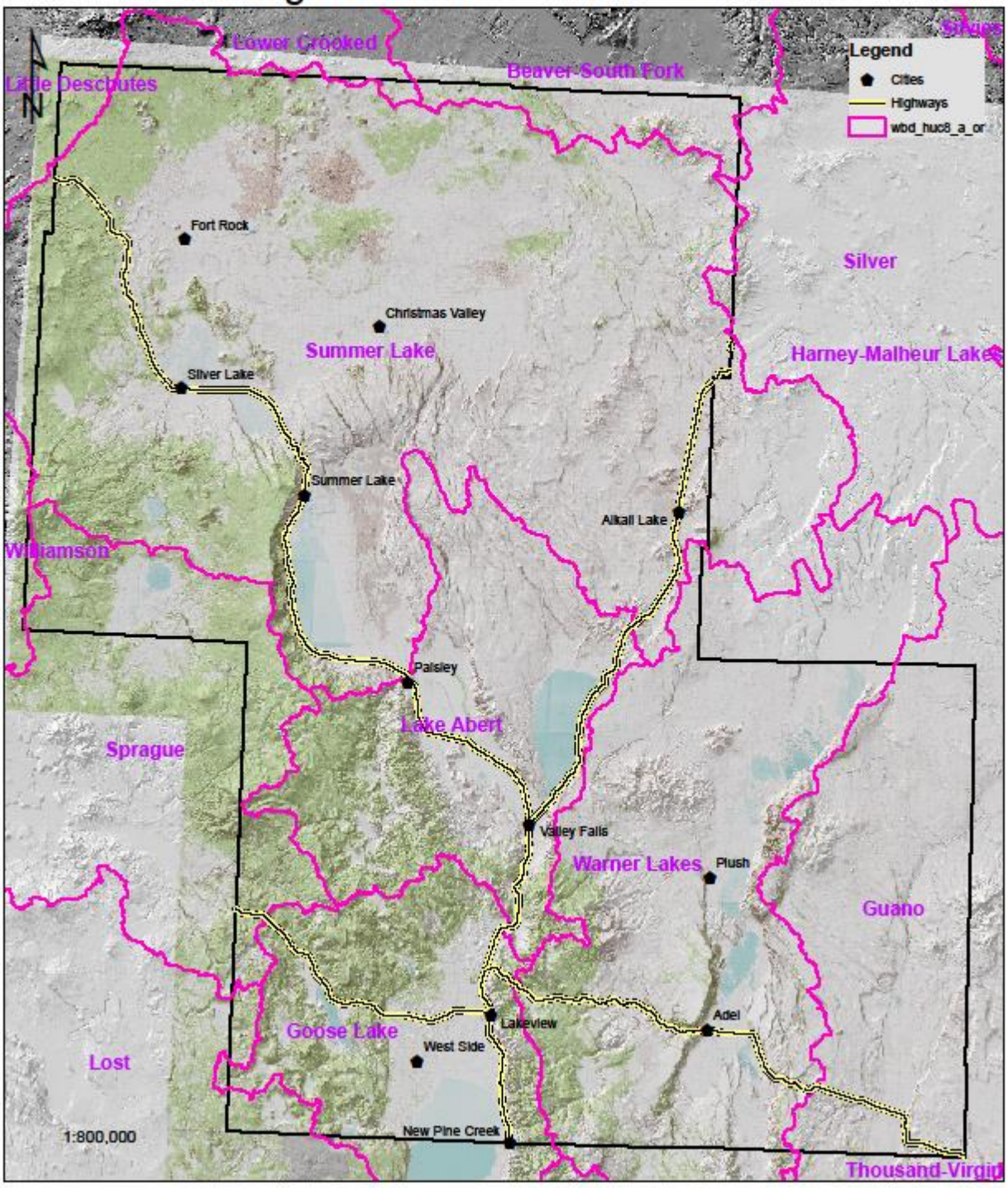


Figure 10

Long Range Plan - Lake County, Oregon
10-digit Watershed Boundaries

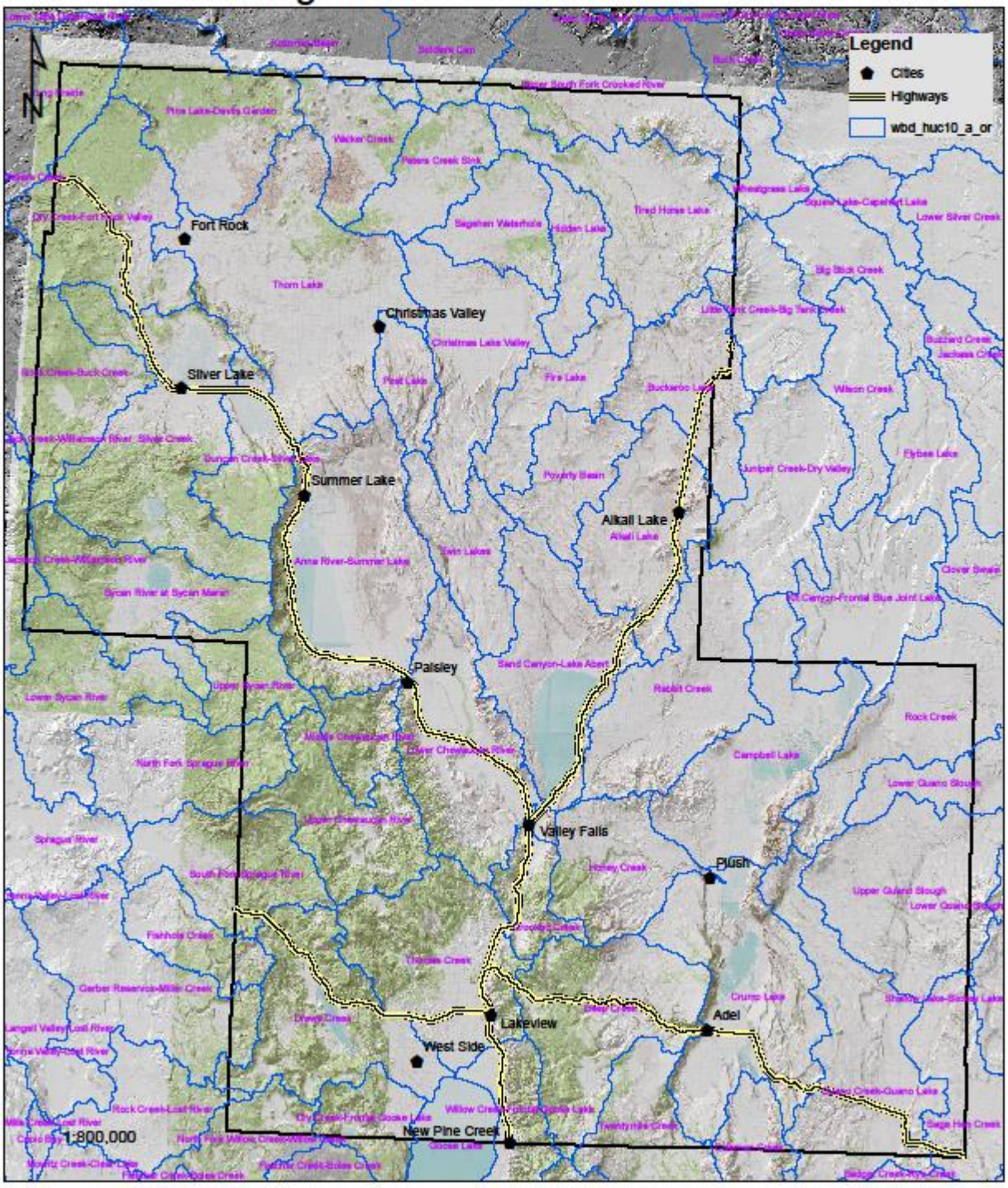
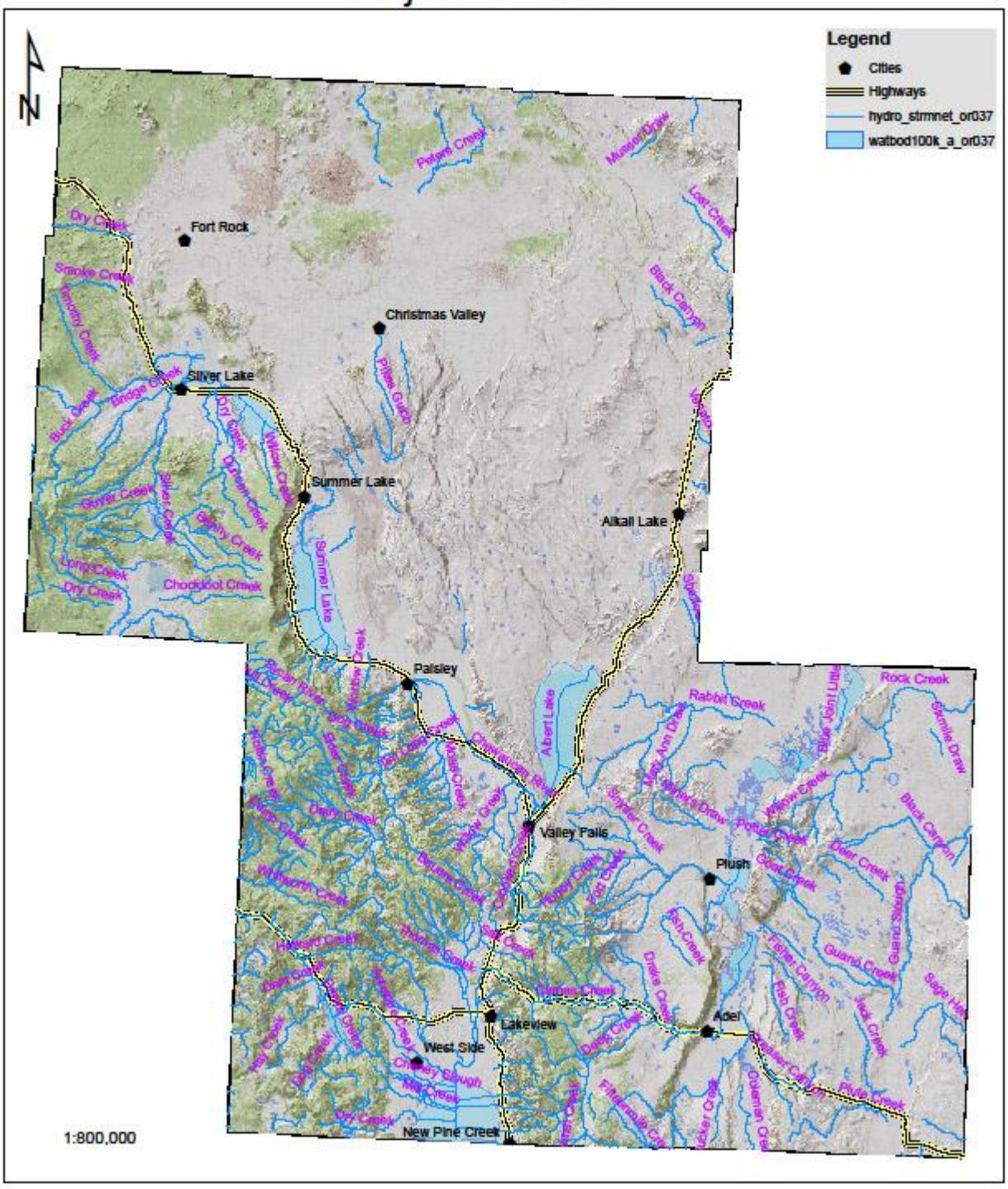
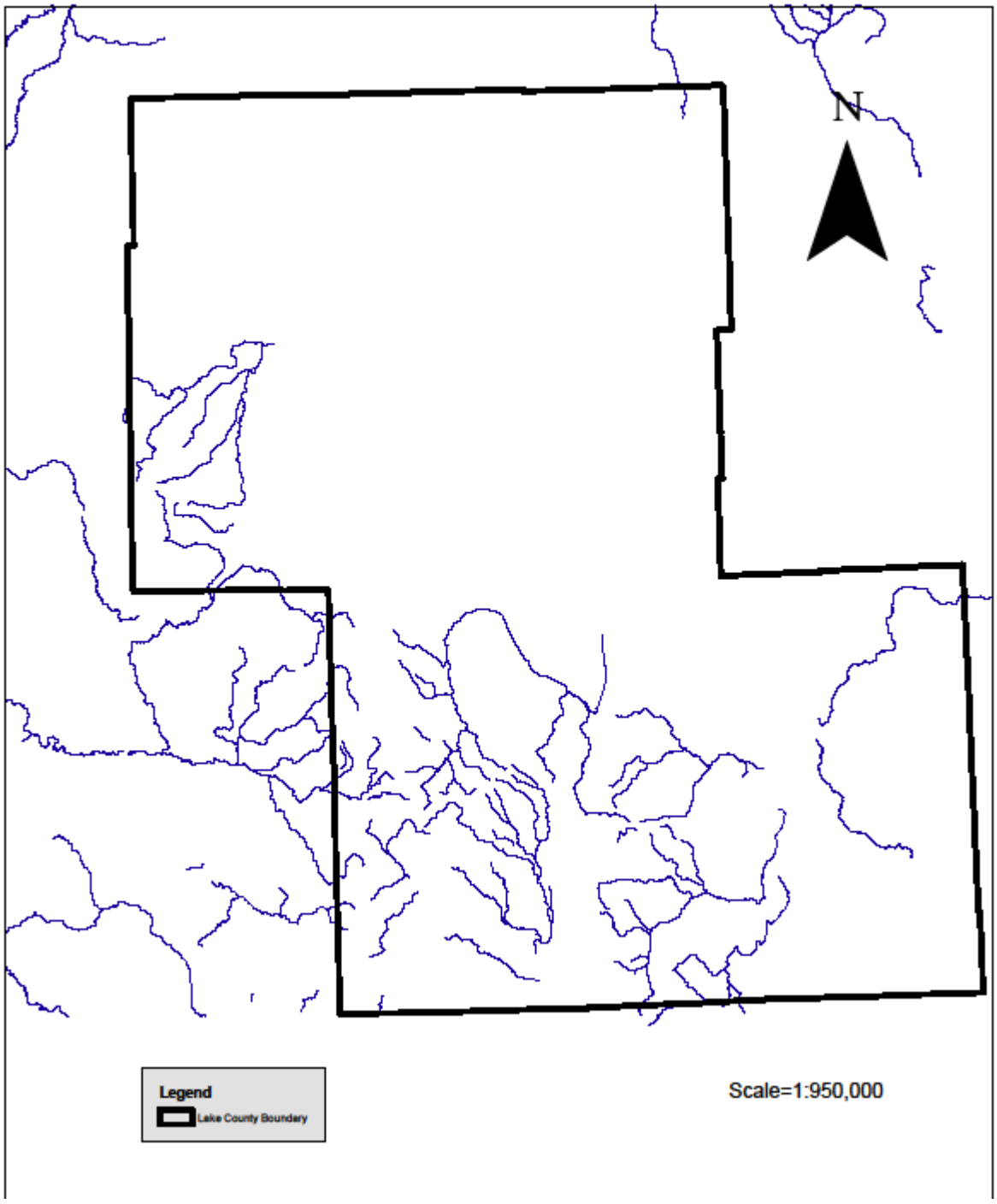


Figure 11

Long Range Plan - Lake County, Oregon
Major Streams



Long Range Plan - Lake County, Oregon
303d Listed Streams - Temperature (Figure 12)



Long Range Plan - Lake County, Oregon
Groundwater Vulnerability and Restricted Areas (Figure 13)

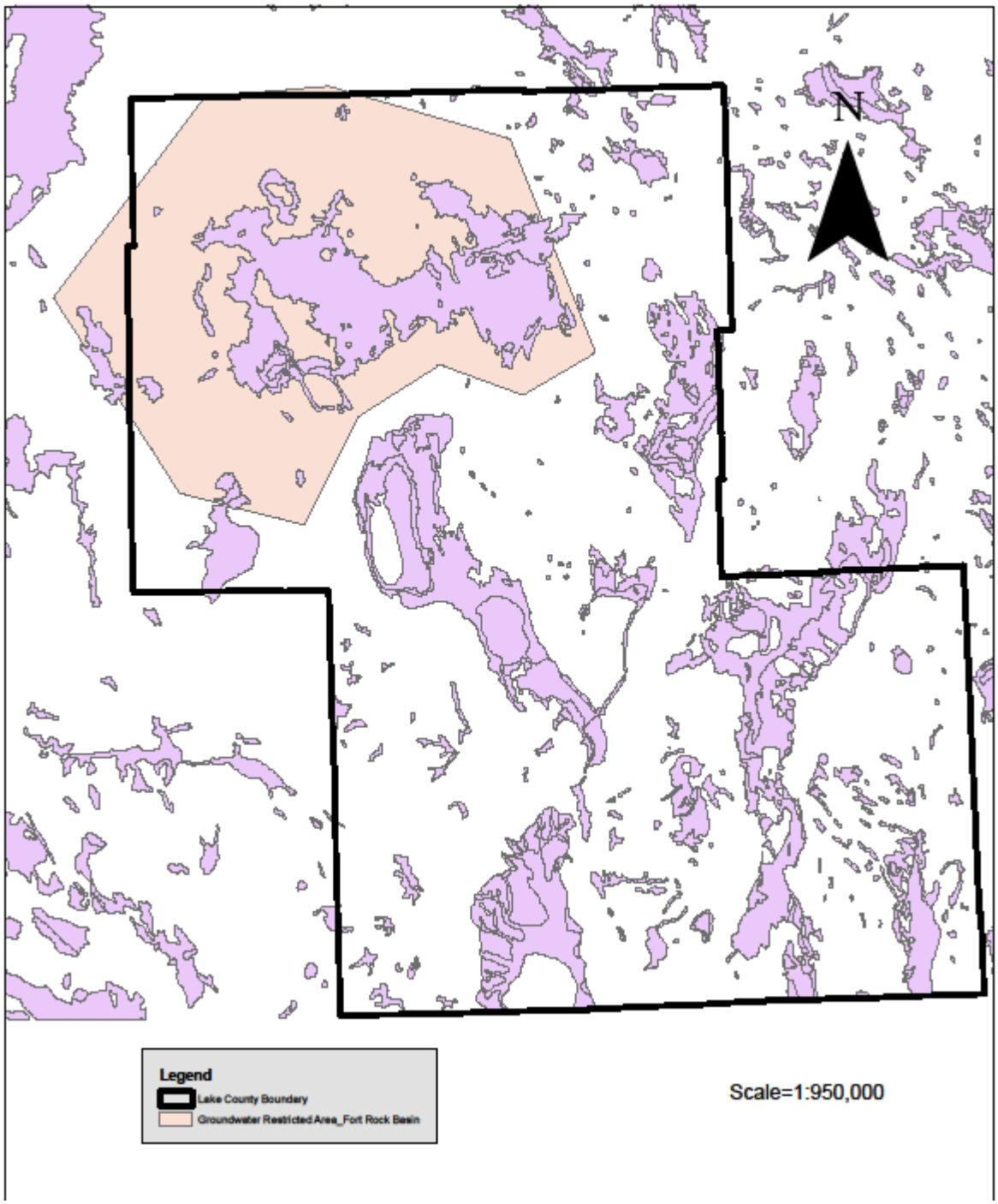
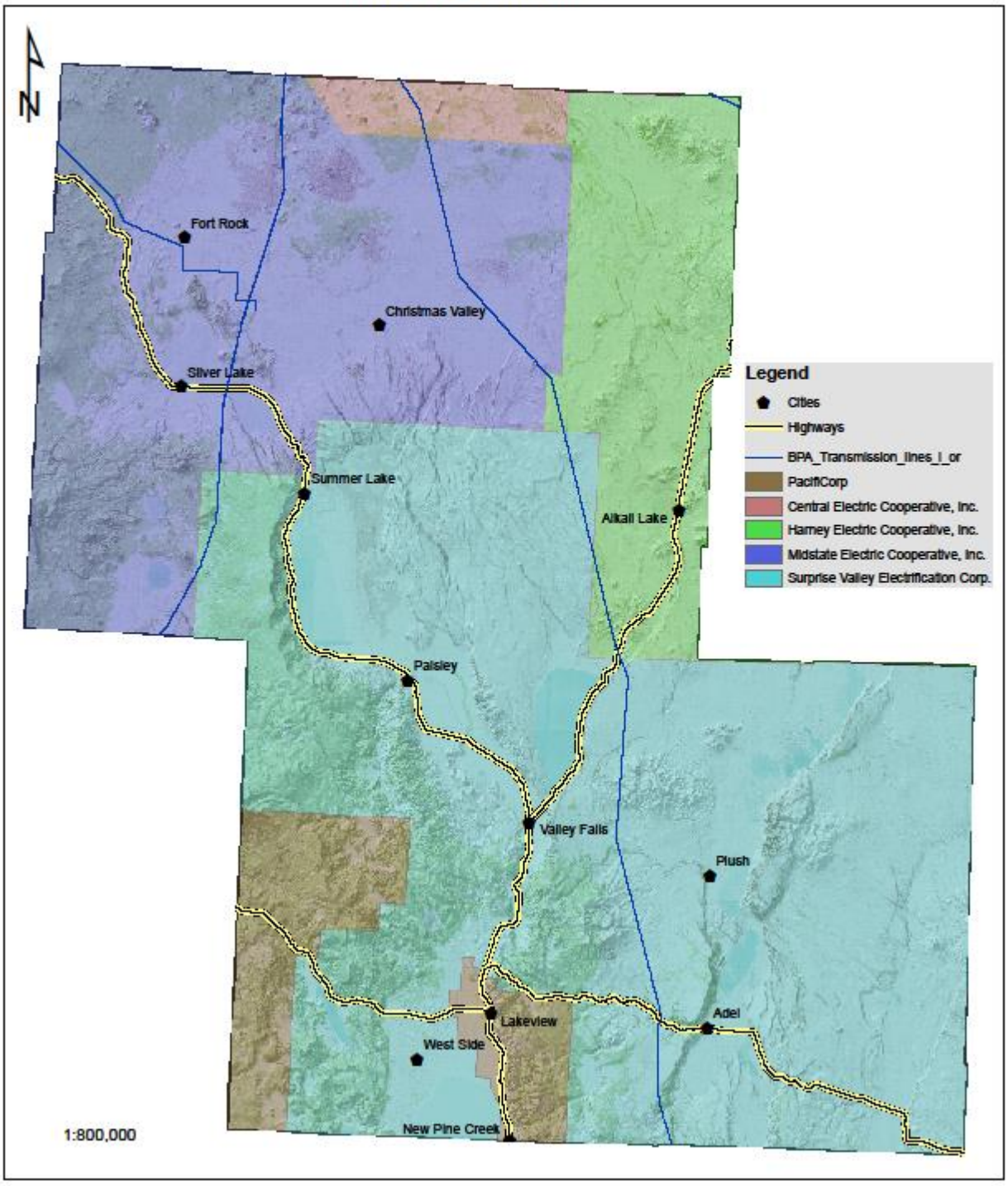
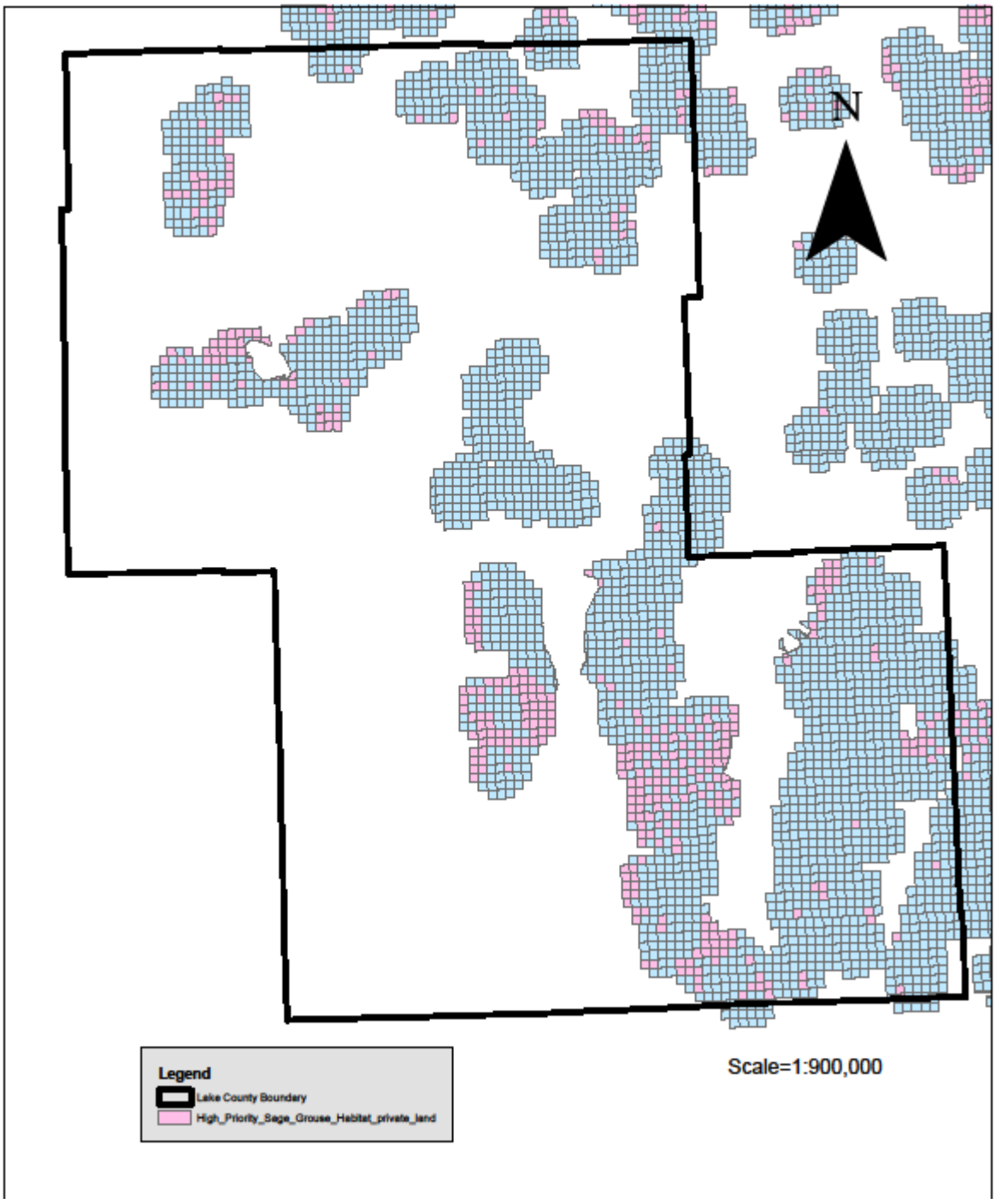


Figure 14

Long Range Plan - Lake County, Oregon
Public Utilities



Long Range Plan - Lake County, Oregon
Sage Grouse Habitat - High Priority (Figure 15)



Long Range Plan - Lake County, Oregon
Wildlife Conservation Opportunity Areas (Figure 16)

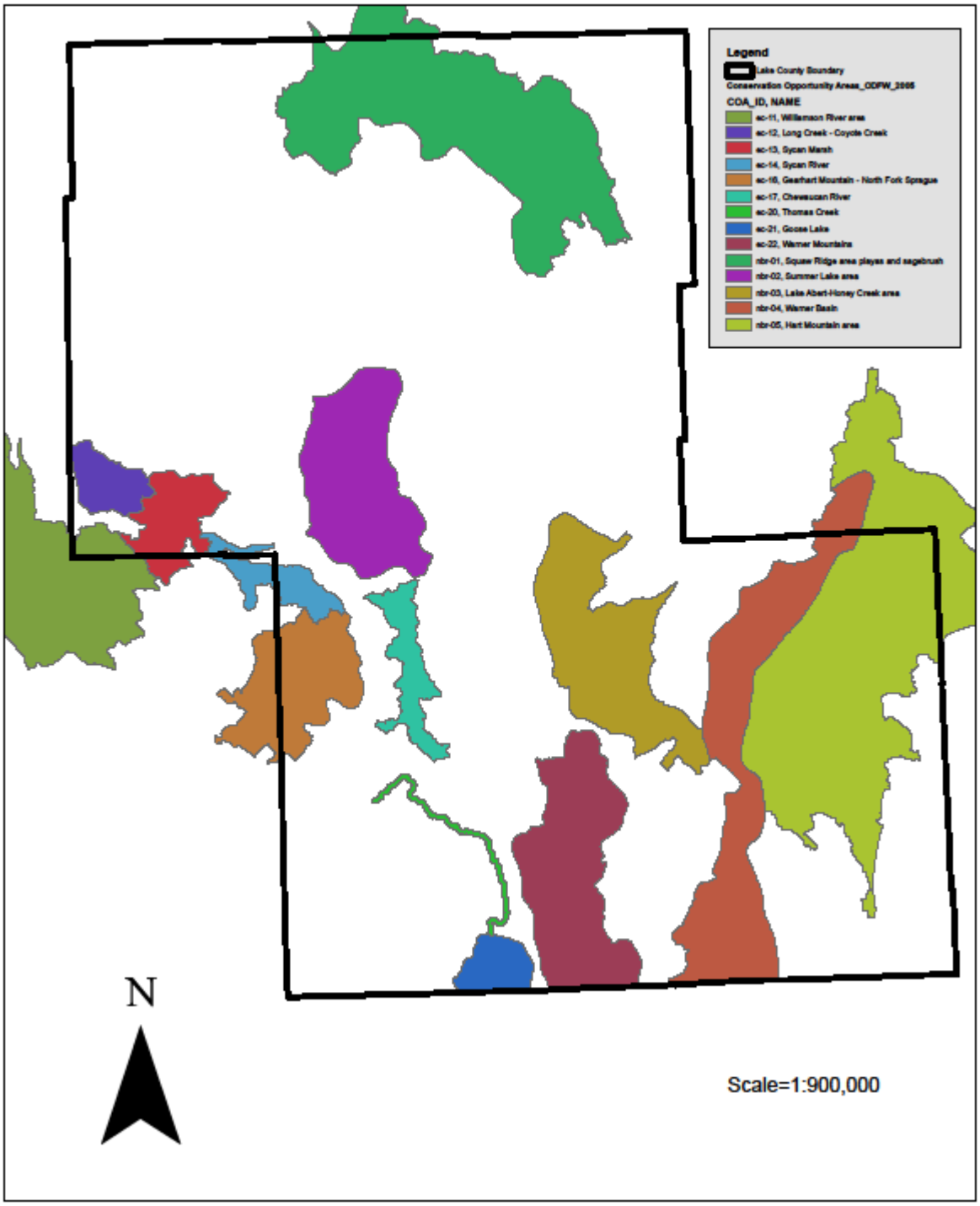


Figure 17

Long Range Plan - Lake County, Oregon
Medusahead Invasion Susceptibility

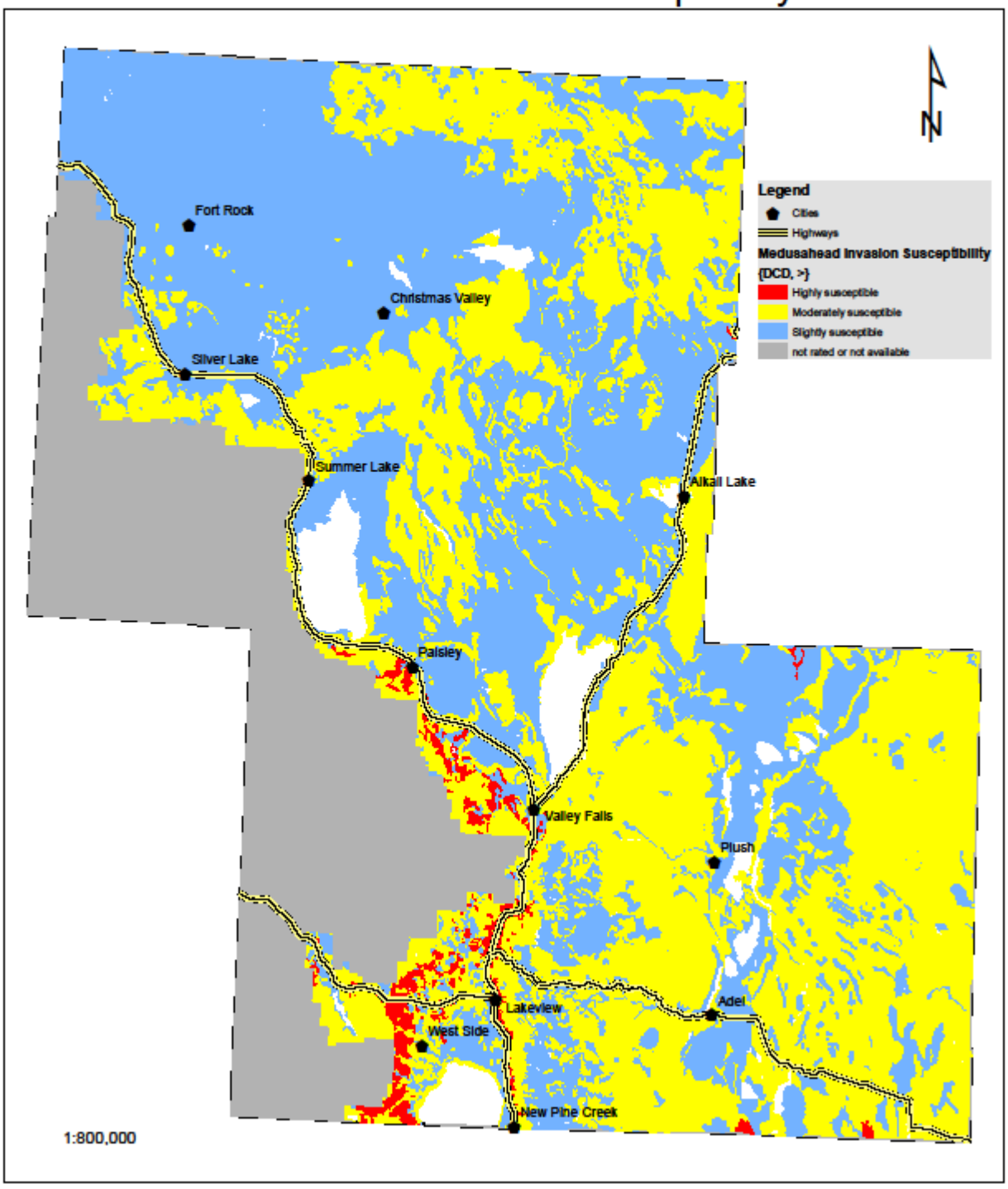


Figure 18

Long Range Plan - Lake County, Oregon
Irrigation Conversion Suitability - Priority Waterbird Areas